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PLANT RESPONSE PARAMETERS TO RECREATIONAL
VEHICLES IN THE CALIFORNIA DESERT CONSERVATION AREA
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Final Report:

"Plant Response Parameters to Recreational
Vehicles in the California Desert Conservation Area (CDCA)"

June 30, 1978

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I. Introduction

Purpose and objectives.

The overall purpose of this project was to study disturbance spectra to arrive at a basis for predicting the effects of recreational use on desert ecosystems, which would help federal land managers intelligently decide how to allocate desert lands for various uses.

Specific objectives were to attempt to contribute information which would help to answer questions of the following types:

1. What kinds of recreational impacts occur.
2. What kinds of plant responses occur.
3. How does the intensity of recreational use relate to the extent of plant response.

The objectives above were to be determined primarily from aerial photographic analysis with on site measurements to fill in certain places where photos were unavailable or to supplement the photo data.

II. Methods

A. Site selection

The time period set for completion of this study did not permit the execution of a carefully designed study projecting far into the future but instead had to rely on interpretation of recent and past experiments inadvertently performed. The seven study sites (appendix D) were selected specifically with a history of recreational and, in the case of area 7, World War II (WWII) use. These sites were selected by Dr. Hyrum B. Johnson and Tad Taylor, Desert Plan Staff, BLM. Contrasting areas such as motorcycle races, intense hill climbing areas, dunes and WWII tank training areas were selected to provide representative vegetative, geographic and use characteristics. Ground photographs were taken at each area depicting a spectra of disturbance sites and controls (appendix F).

B. Materials

Materials consisted mainly of items needed for analysis of aerial photographs and film, materials for ground transect and plot measurements, calculators, and four wheel drive vehicles for reaching field sites. Most of the items will be mentioned in the photo and ground methods sections. Symbols and calculations used in aerial and ground analysis are listed in appendix B.

C. Aerial photographic analysis.

Study areas were located on aerial photographs for both test and control sites. The ideal control was a comparable photo before disturbance, usually 1952-1953. These dates were too recent for area 7 (Patton WWII camps) however. In cases where a control

photo was lacking, a site on the test photo that was in an undisturbed location with the same vegetation type and physiognomic character as the disturbed site was used as a control. Dates for the test (disturbed) photos were usually early to late 1970's.

Uncalibrated aerial photos were calibrated by comparing exact ground and aerial distances between known landmarks. Transparent dot and plot grids were calibrated for each photo (appendix E) for the purpose of measuring total density and cover of perennial vegetation in test and control plots. The ratios for prints and grids were calibrated for each elevation level.

For measurements of total density the transparent grids were placed over the sample sites and the number of shrubs (visible with the aid of 4X magnifier lenses attached to standard stereoviewer) counted within transect plots (K). When control photos were available, the grid was placed in the identical position on both test and control sites. Density was calculated by standard procedures using the photo and grid calculations previously determined. In most cases, density was expressed as density, no/.04 ha or .12 ha, depending on the calibration ratio of the photo. When either the test or control photo lacked a suitable "stereo pair", the transparent grids were used with a regular stereo dissecting microscope for density counting. The extra magnification of this type of scope tended to off-set the loss of contrast so valuable in the stereoscope. The sample size for most of the study sites is indicated by K and N (number of shrubs or plants counted) in the tables of results.

Cover was measured by use of a calibrated line transect divided

into ten sections and superimposed onto a Bausch and Lomb Filar micrometer eyepiece attached to a standard stereo dissecting microscope with a magnification factor of .7. A moving needle calibrated in increments of .001 was used to measure the vegetation on the transect line which was placed over sample sites of both the control and test photos. The sum of the vegetational distance was divided by the length of the transect line (1000 micrometer units) and multiplied by 100 to yield the relative cover on each transect line. This method of estimating cover of perennial vegetation on photographs has the advantage of more accuracy than estimating distance covered on a line with the standard transparent grid. The needle of the micrometer can be placed directly beside a shrub, the micrometer reading taken, and then moved to the opposite side of the shrub and read again.

Sample site selection on the photos considered such criteria as homogeneity of the vegetation, presence of a disturbance type and the presence of a matching undisturbed area for control (usually an earlier photograph taken before disturbance). Samples were taken in several different disturbance categories, such as pit areas, hillside and level trails, raceways, tracks, etc. While it is impossible to detect and measure every shrub that is visible on a comparable ground site, the photo analysis tended to yield similar trends as the ground measurements did. Thus photo and ground measurements are shown together for many areas but always in separate tables or graphs.

D. Ground analysis

On site measurements were taken to supplement photo analysis in a few representative areas but not in all of them. In a few cases (Afton and Jawbone Canyons, and Stoddard Valley) ground measurements were taken because of the unavailability of aerial photographs of disturbance sites.

Ground measurements, like the aerial photo analysis, were used primarily to calculate density and cover. Since it was possible to identify each species on the ground, percentage composition tables were also prepared.

Most ground sites were measured for density and cover of perennial vegetation in various disturbance and community types and also in a comparable nearby undisturbed plot for a control. The point-quarter method was used for most areas, sampling at a minimum of 30 points (K) for each disturbance type or control. Density and covered were calculated from field data following standard formulas for such calculations (Brower and Zar, 1977). Some areas, such as Jawbone Canyon and Dove Springs, where large expanses of denuded vegetation discourage use of the quarter-method, line transects were used. Density and cover were calculated by standard methods also outlined in Brower and Zar (1977).

Measurements of vegetation in creosote bush scrub were taken Dec. 11, 12 and 18, 1978 at the starting area of the Barstow to Vegas Motorcycle Race of Nov. 30, 1974 near Yermo, California, for the purpose of testing edge effect of motorcycle tracks (Tables 1 and 7, Fig 1, area 6).

Edge effect was tested for by 1500 point samples at 75 randomly selected sites along 3 transect lines. One transect contained 10 tracks (sparse), a second contained 38 tracks (dense), both through the race path. A third transect containing 45 tracks was through a pit area. Cover and composition were determined following standard formulas for point measurements (Brower & Zar, 1977).

E. Statistical considerations

Limited statistical analyses were made for a few representative sample sites measured on aerial photographs. The quarter method and the line transect method of the ground measurements do not lend themselves to an evaluation of means from which the statistical summaries are based. (See statistical summaries in selected area tables and appendix B for symbols). Standard error of the mean ($S\bar{x}$) was determined for some bar graphs of aerial photo analysis but is available as yet only in the raw data on file at Loma Linda University.

The formula for determination of percent change of vegetation in relation to disturbance intensity = $\text{test} - \text{control} \div \text{control} \times 100$

Results

Results are shown primarily in the form of tables and graphs for each study area with summary graphs depicted in the conclusions. In general, the impacts of recreational uses, primarily by recreational (RV) and off-road (ORV) vehicles, upon the California desert plants and their habitats cause negative responses by perennial plants. The degree of negative response varies with conditions and use intensity. Some positive responses were detected in annuals at area 6 where deep tracks in sand created an edge effect, collecting rain water and seeds in the swales of the tracks. Concentrated current or recent past vehicle use in localized areas tends to create the greatest negative plant response and one-time motorcycles races, with dissipated activity and with time allowance for plant recovery, appears to have the least negative response. Concentrated but distant past type use intensities (Patton's training camps) with long periods of time for recovery come somewhere in between these two negative response types (Fig. 18, Table 1 conclusions).

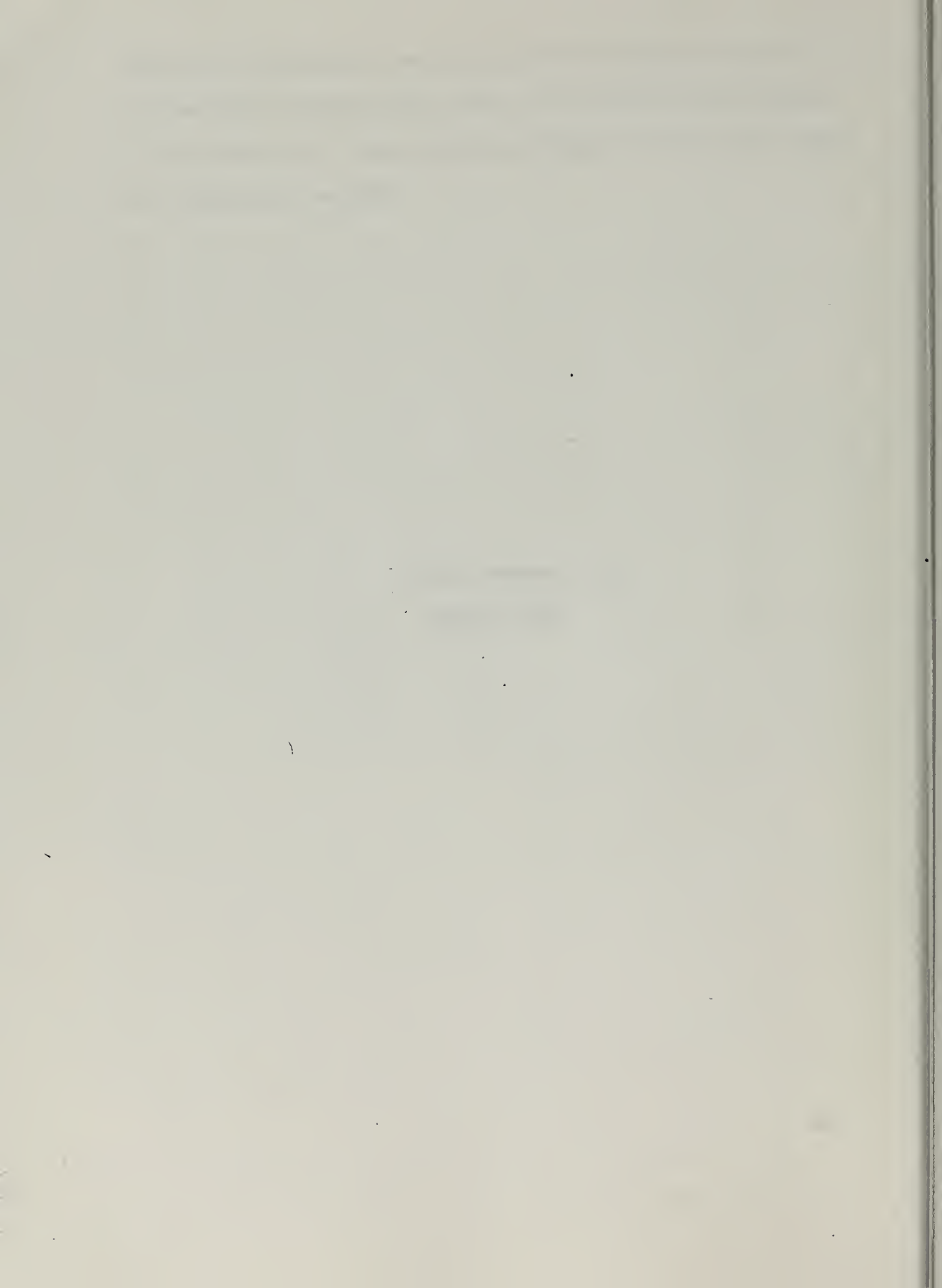
Ground measurements tables of percent composition data collected at some sites show differences in composition between control and test sites, indicating that recreational impacts do alter plant stability and diversity to some extent. Productivity also tends to be affected by recreational impacts as the data on cover changes between test and control sites indicate. Stability tends to be reduced when recreational impacts are such that the dominance of long-lived perennials of a particular area is reduced or altered.

The data from both aerial photographic analysis and ground transects indicate negative response by perennial vegetation to most types and

degrees of recreational vehicle use intensities as studied in representative sample sites (areas 1-7) of the California Desert Conservation Area. See summary data tables and figures for areas and conclusions sections.

Area 1 Jawbone Canyon

Dove Springs

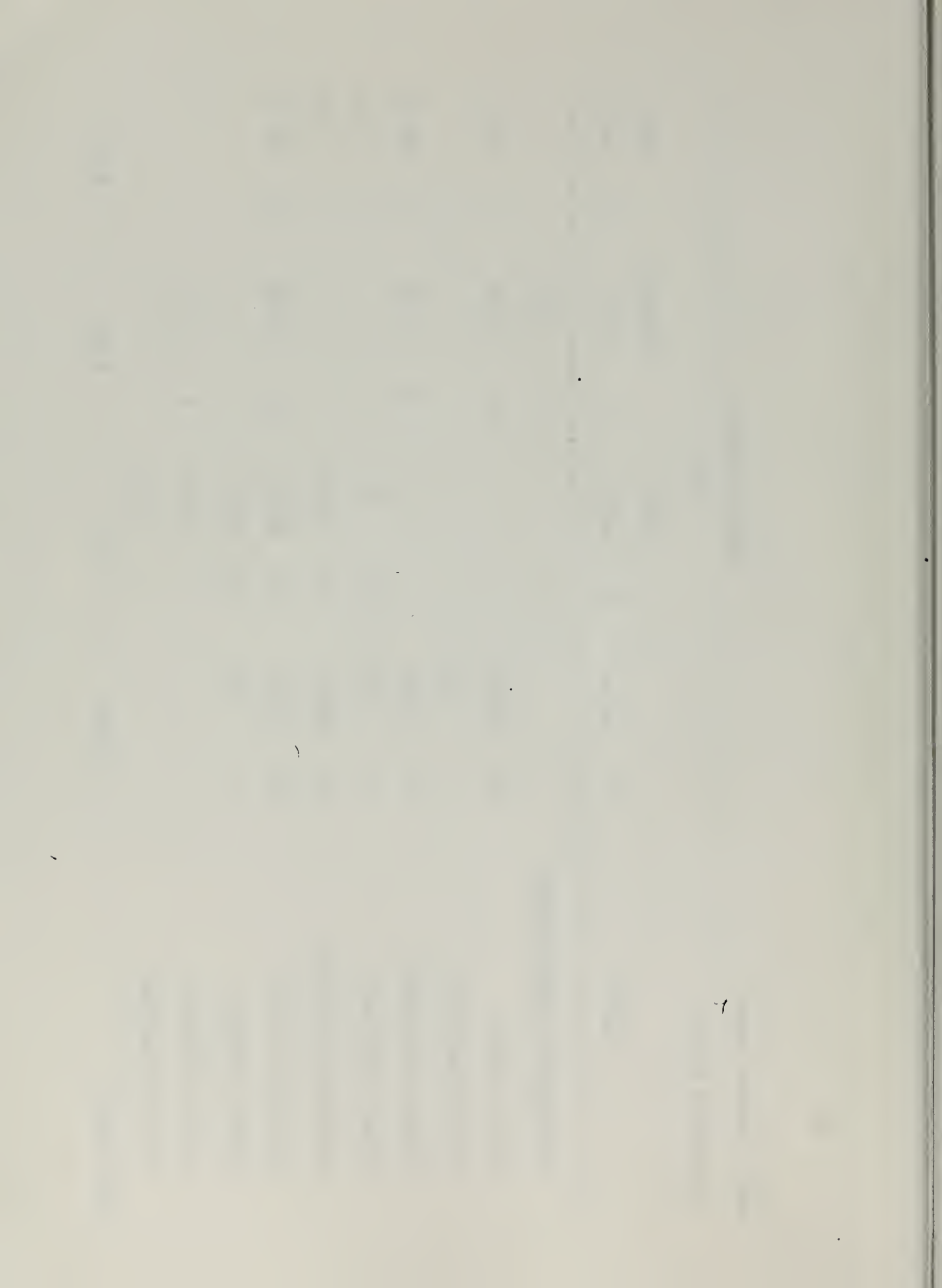


Site	L(m)	Density I	Cover %
A. Hillside, sparse trails	200	.19	11.31
B. Hillside, dense trails	200	.21	8.36
C. Hillside, very dense trails	200	.15	4.65
D. Hillside, control	200	.36	17.48
E. Pit area	200	.09	2.64
F. Pit area, control	200	.50	28.89

Area 1 Jawbone Canyon

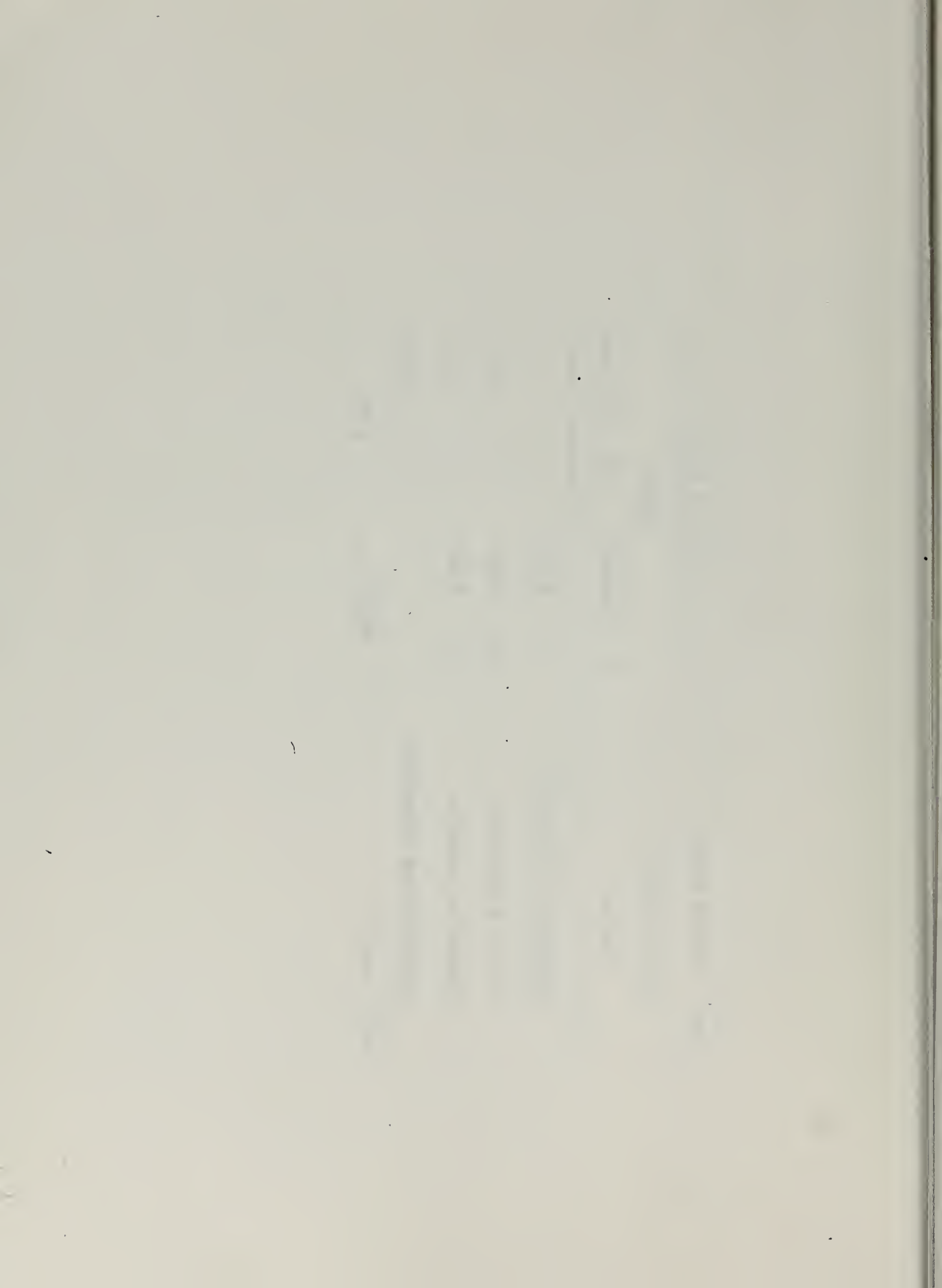
Cheesebush scrub

Species	Relative Cover					
	Sites					
	N	Control	N	Sparse Trails	Moderate Trails	Dense Trails
<i>Acamtopappus sphaerocephalus</i>			2		5.62	
<i>Ambrosia dumosa</i>	12	20.13	12		21.28	2 6.24
<i>Atriplex polycarpa</i>	1	.91				
<i>Encelia virginensis</i>	4	6.80	3		4.72	4 20.64
<i>Ephedra nevadensis</i>	4	.34	1	.97		2 1.29
<i>Erigonum fasciculatum</i>	12	19.42	1	2.65		1 3.44
<i>Hymenoclea salsola</i>	39	51.99	23	60.01	21 54.99	11 56.77
<i>Isomeris arborea</i>	1	.40	3	12.99		
<i>Larrea tridentata</i>			3	12.24	4 13.39	
<i>Salazaria mexicana</i>			7	11.13		
Total cover %		17.48		11.31	8.36	4.65



Area 1 Jawbone Canyon

Area 1 Jawbone Canyon		Relative Cover		
Species	N	Sites		Pit Area
		Control	N	
Artemisia californica	1	5.66		
Atriplex polycarpa	76	63.80	11	55.33
Hymenoclea salsola	6	3.80	2	17.21
Lepidospartum squamatum			5	27.45
Total cover %		28.89		2.64



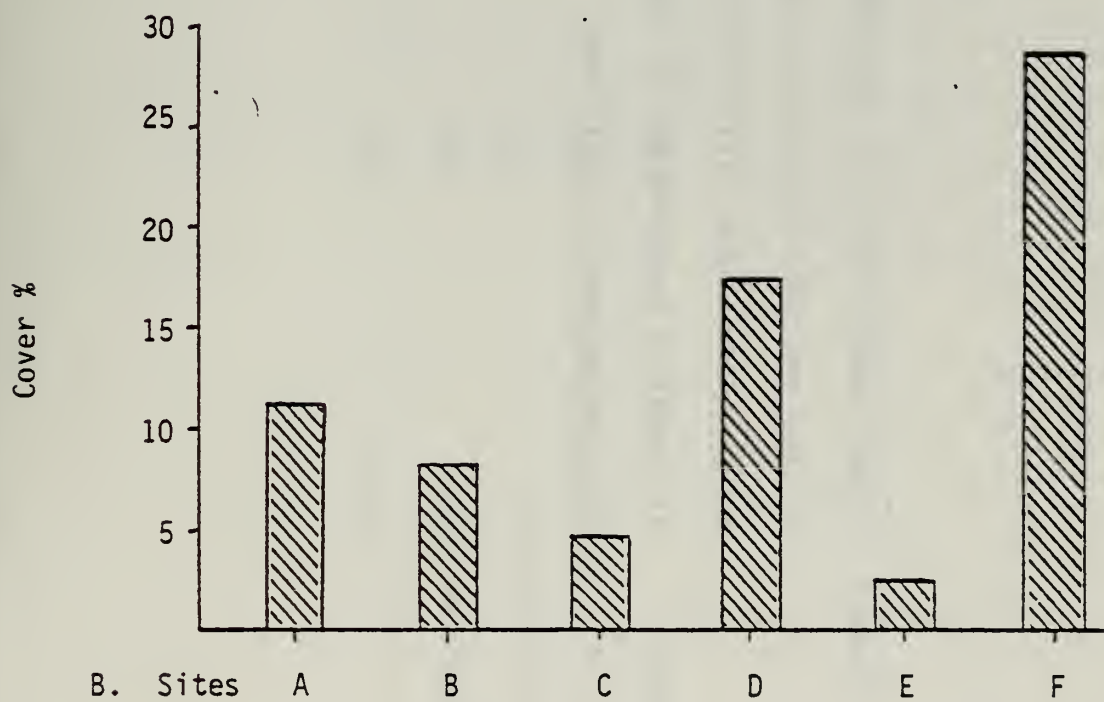
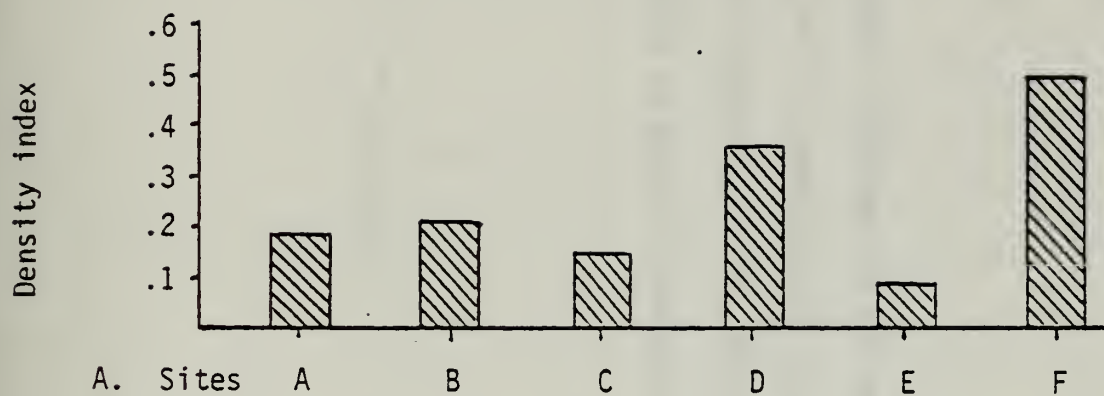


Table 1. Linear density index (I) and mean cover (%) for perennial vegetation of recreational and off-road vehicle use areas of Dove Springs, 38 Km northeast of Mohave, Kern County California, T29S, R37E, Sec. 8. Ground line transects (L=length m) measured May 21, 1978 in cheesebush scrub on denuded, partially denuded and control hillsides.

Sites	L(m)	N	Density I	Cover %
Denuded hillside	200	0	.0	.0
Denuded hillside	200	0	.0	.0
Partially denuded hillslope	200	40	.2	7.8
Control	200	113	.56	21.9

Table 2. Mean density, no./0.04 ha ($\bar{N}$), of perennial vegetation before (Oct. 15, 1952) and after (May 27, 1973) use by recreational vehicles in Dove Springs Canyon, 38 Km northeast of Mohave, Kern County, California as determined from aerial photographs. Transect sites 1-8 occur progressively into the canyon starting at T29S, R37E, Sec. 20 and terminating with site 8 at T29S, R36E, Sec. 1.

Site	Density no/.04 ha			
	K	N	1952	1973
1. Pit area and hillside trails	180	2066	11.4	
	180	1699		9.43
2. Hillside trails	180	1727	9.59	
	180	852		4.73
3. Hillside trails	180	2086	11.59	
	180	1290		7.17
4. Hillside trails	180	2907	16.15	
	180	1070		5.94
5. Pit area	180	1876	16.45	
	180	751		4.17
6. Pit area	180	1989	11.05	
	180	937		5.21
7. Hillside trails	180	3456	19.2	
	180	1651		9.17
8. Pit area	270	3107	11.51	
	270	1744		6.46

Area 1 Dove Springs		Relative Cover		
Cheesebush scrub		Sites		
Species		N	Control	Hillside trails
<i>Acamptopappus sphaerocephalus</i>		18	3.01	6 1.61
<i>Ambrosia dumosa</i>		1	.11	
<i>Ceratoides lanatum</i>		3	1.47	
<i>Ephedra nevadensis</i>		18	2.62	3 .22
<i>Erigonum fasciculatum</i>		16	3.52	2 .29
<i>Grayia spinosa</i>		2	.21	1 .36
<i>Hymenoclea salsola</i>		36	6.86	23 4.52
<i>Larrea tridentata</i>				2 .58
<i>Opuntia echinocarpa</i>		2	.12	
<i>Salazaria mexicana</i>		7	.98	3 .21
<i>Tetradymia stenolepis</i>		13	3.4	
Total cover %		22.04		7.81

Table 4. Statistical summary of comparison of mean values for density at control and test sites in Dove Springs Canyon. See Table 2 and Figure 1.

<u>Values</u>	<u>Sites</u>	
	<u>Test</u>	<u>Control</u>
$\bar{X}$	6.53	13.36
SD	1.95	3.4
t		4.9
DF		11
P ₁		4.59

Figure 1. Bar graph showing mean density of perennial vegetation before (□ Oct. 15, 1952) and after (■ May 27, 1973) use by recreational vehicles in Dove Springs Canyon, 38 Km northeast of Mohave, Kern County, California as determined from aerial photographs. (See Table 2.)

Density no/.04 ha

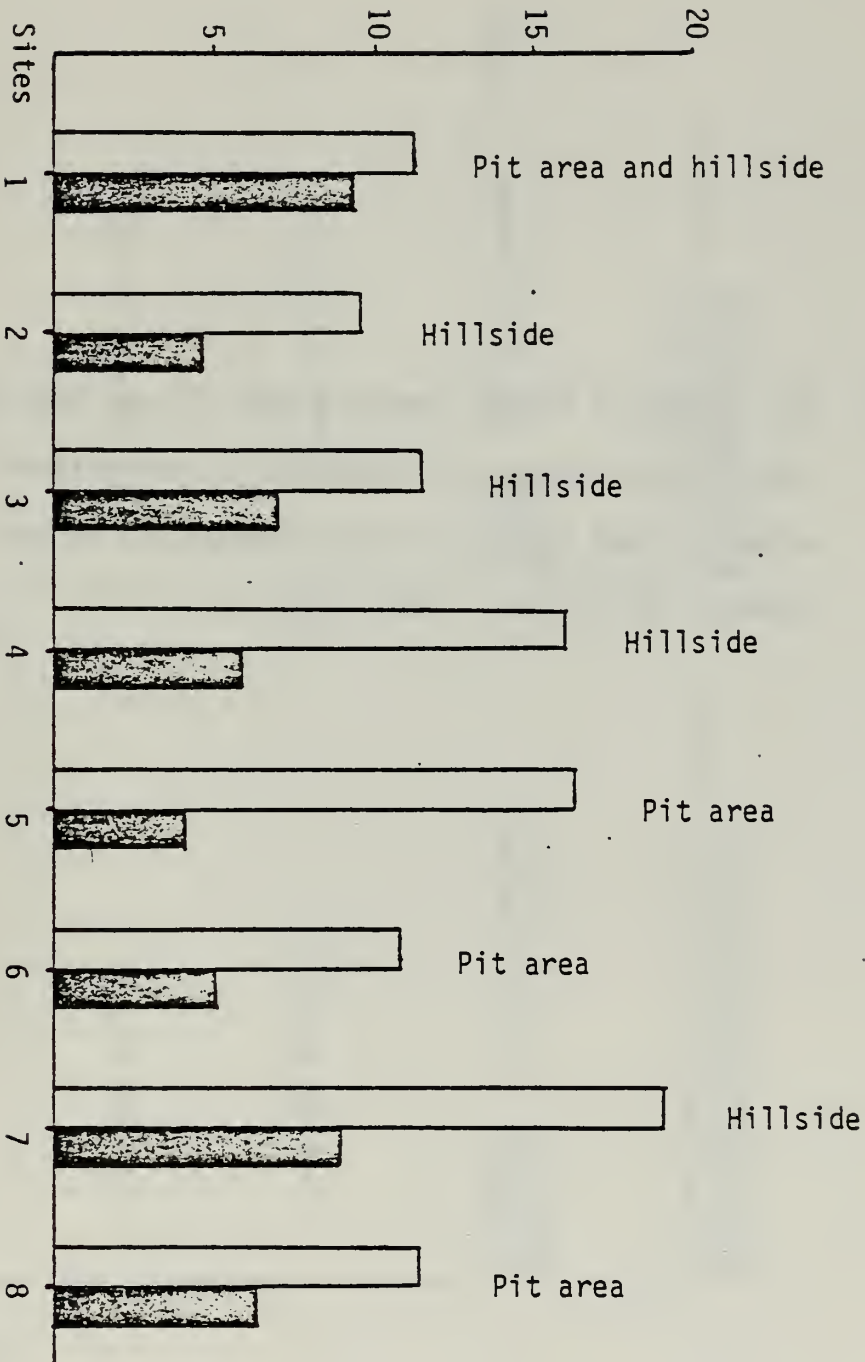
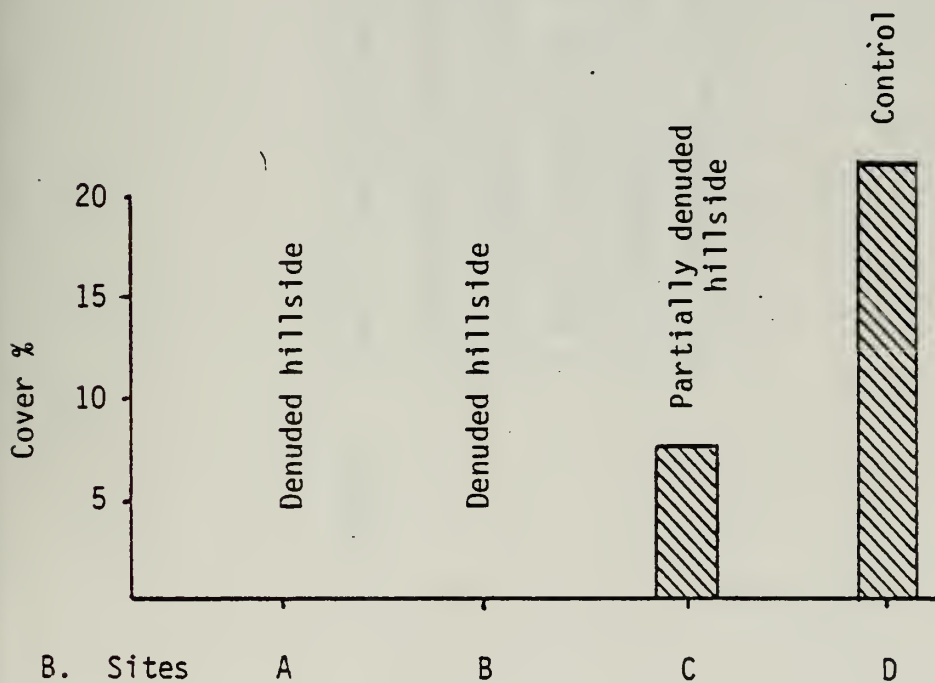
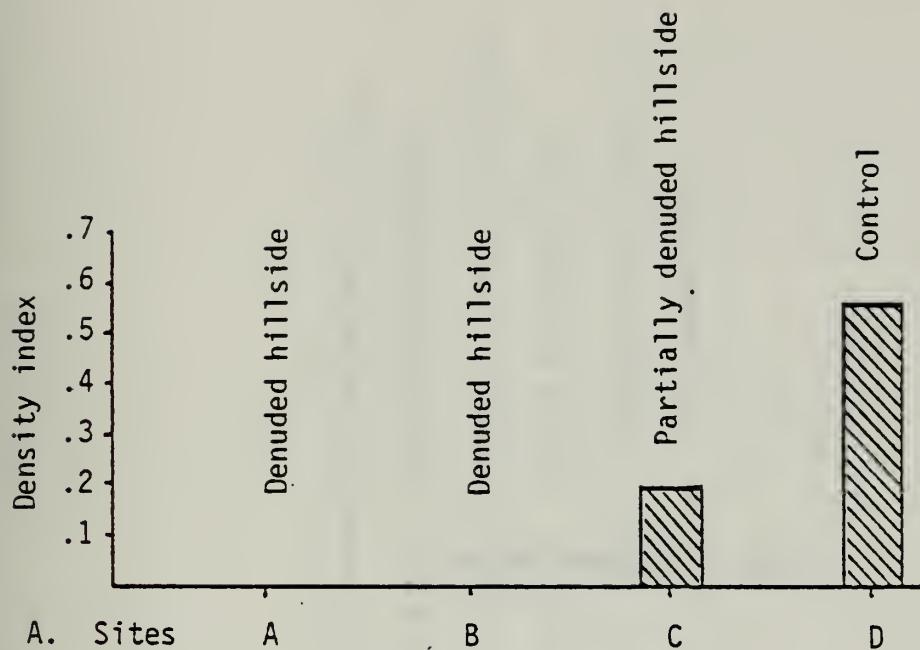


Figure 2. Bar graphs of linear density index (A) and mean percent cover (B) of perennial vegetation at recreational use areas of Dove Springs, 38 Km northeast of Mohave, Kern County, California. (See Table 1.)



Area 2 Stoddard Valley

Table 1. Density and cover means for perennial vegetation in recreational and off-road vehicle use sites in Stoddard Valley, 4 Km southwest of Barstow, San Bernardino County, California, T 9N, R 2W, Secs. 26, 27 and 35. Ground transects plots (K) measured May 14 and 28, 1978 in creosote bush scrub (Secs. 26, 27) and alkali sink (Sec. 35) communities.

Sites	K	N	Density no/ha	Cover m ² /ha
Creosote bush scrub				
Pit area	30	120	8.79	.97
Hillside trails	20	80	175.05	39.53
Raceway	31	124	108.19	7.17
Control	30	120	1168.2	531.08
Alkali sink				
Pit area	30	120	2.42	18.13
Control	30	120	416.63	938.23

Table 3. Relative cover (% composition) and total percent cover of perennial vegetation in recreational and off-road vehicle use sites in Stoddard Valley, 4 Km southwest of Barstow, San Bernardino County California, T 9N, R 2W, Sec. 35. Ground measurements taken May 14, 1978.

Area 2 Stoddard Valley

Relative Cover

Creosote bush scrub

Sites

Species	N	Control	N	Hillside	N	Raceway	N	Pit area
<i>Ambrosia dumosa</i>	50	7.17	14	6.68	50	15.58	51	25
<i>Atriplex polycarpa</i>	2	.36					5	14
<i>Cassia armata</i>	2	.97	1	.44	.1	.58	10	27
<i>Coleogyne ramosissima</i>					13	9.78	23	21
<i>Hymenoclea salsola</i>			1	.27				
<i>Larrea tridentata</i>	66	91.5	53	91.04	60	74.04	27	69
<i>Stephanomeria pauciflora</i>							4	10
<i>Yucca schidigera</i>			1	1.56				

Total cover % 5.31 395 072 0097 . . .

Table 2. Relative cover (% composition) and total percent cover of perennial vegetation in recreational and off-road vehicle use sites in Stoddard Valley, 4 Km southwest of Barstow, San Bernardino County, California, T 9N, R 2W, Sec. 26 and 27. Ground measurements taken May 14 and 28, 1978.

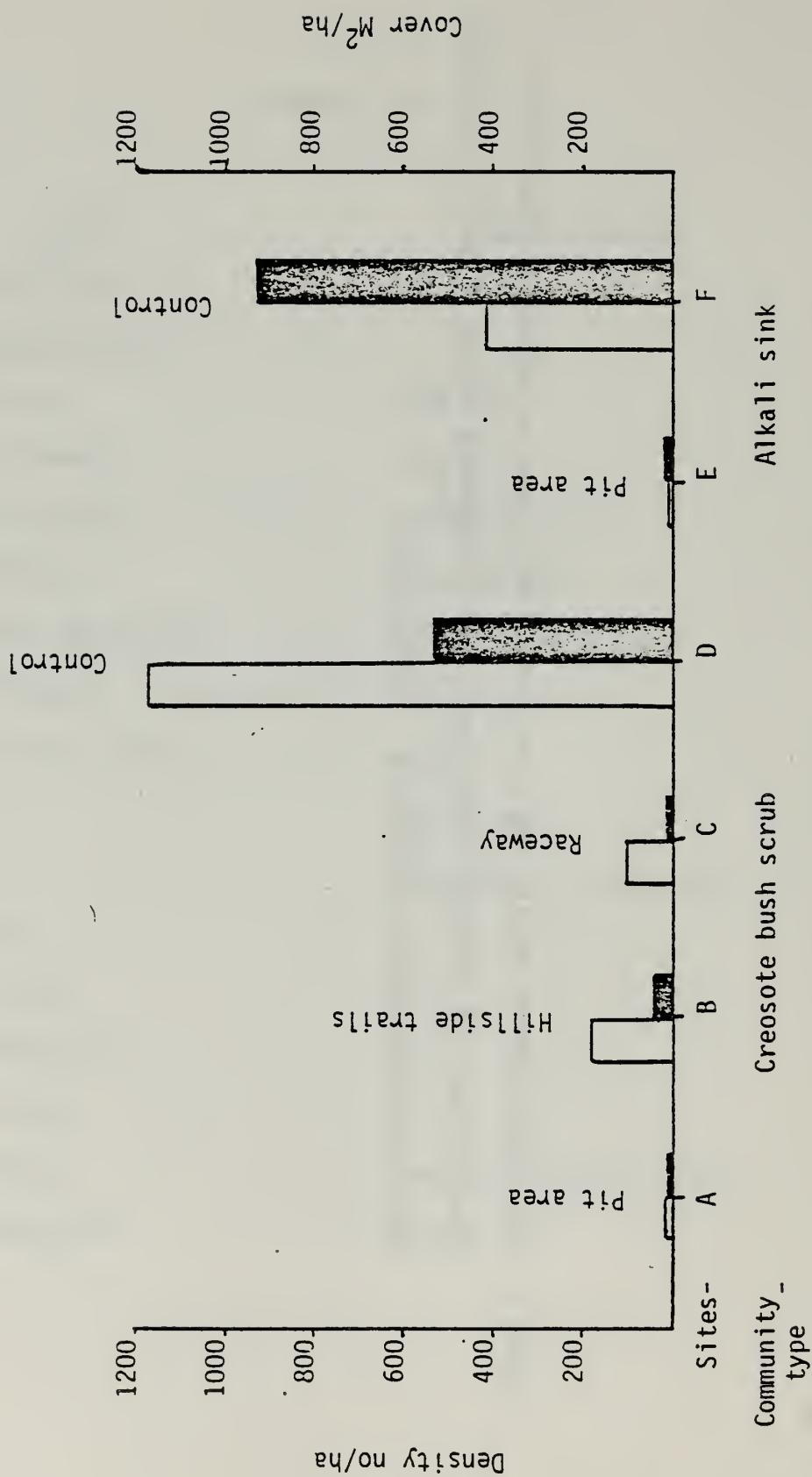
Area 2 Stoddard Valley		Relative Cover		
Alkaline Scrub		Sites		
Species		N	Control	Pit Area
<i>Ambrosia dumosa</i>		57	11	28 10
<i>Atriplex polycarpa</i>		47	65	56 67
<i>Ceratoides lanatum</i>		5	6	
<i>Ephedra nevadensis</i>		4	2	11 13
<i>Grayia spinosa</i>		1	3	12 6
<i>Hymenoclea salsola</i>				3 1
<i>Larrea tridentata</i>		6	15	
Total cover %		9.38		.18

Table 4. Summary data of soil characteristics of
Stoddard Valley study site, 4 km southwest
of Barstow, San Bernardino County, California,
T9N, R2W, Sec 26 and 27. Analysis by Al Endo.

SUMMARY DATA

<u>Site</u>	<u>Stoddard Valley</u>
Physiographic	
<u>Characteristics</u>	
Elevation	2700 ft. ✓
Slope/aspect	4-5% SW
Parent rock	mixed alluvium
Landform	Alluvial fan
Surface conditions	80-90% loose gravel
Consistency	
Dry, Moist, Wet	hard
	very friable
	non-sticky, non-plastic
Texture	
Surface	GrS
Subsurface	GrS
Structure	
Surface	Stonrg med-course, platy
Subsurface	massive

Figure 1. Bar graph showing density (□) and cover (■) means for perennial vegetation in recreational and off-road vehicle use sites in Stoddard Valley, 4 km SW of Barstow, San Bernardino County, California. (See Table 1).



Area 3 Johnson Valley

Table 1. Mean density/no .12 ha ($\bar{N}$) of perennial vegetation before (November 26, 1952) and after (May 28, 1977) establishment of a recreational pit area of Johnson Valley, T5N, R3E, SW $\frac{1}{4}$ sec. 22, San Bernardino Base Line, California as determined from radiating transects of .12 ha plots (K) placed at random compass degrees from the center of the pit area on aerial photographs. Transect site A=35°; B=65°; C=140°; D=180°; E=200°; F=215°; G=330°; H=360°.

<u>Site</u>	<u>K</u>	<u>N</u>	<u>Density no/.12 ha</u>	
			<u>1952</u>	<u>1977</u>
A	89	1139	12.7	
	85	386		4.5
B	86	1093	12.7	
	86	529		6.2
C	90	1154	12.8	
	90	677		7.5
D	89	1125	12.8	
	90	740		8.6
E	90	815	9.0	
	90	414		4.6
F	90	730	8.1	
	90	440		4.9
G	90	1154	12.8	
	84	628		7.5
H	34	422	12.4	
	24	157		6.5

Table 2. Statistical summary of comparisons of mean values for density in study sites of Johnson Valley. See Table 1 and Figures 1 and 2.

Pit area

Values

1952

1977

$\bar{x}$

11.63

6.23

SD

1.92

1.44

Paired-t

10.05

DF

7

P

.000021

$n? = 8?$ →

Figure 1. Mean density (number per .12 ha plot) of perennial vegetation before (□, November 26, 1952) and after (■, May 28, 1977) establishment of a recreational pit area of Johnson Valley, T5N, R3E, SW $\frac{1}{4}$ sec. 22, San Bernardino Base Line, California as determined from six radiating transects placed at random compass degrees from the center of the pit area on aerial photographs. Transect A = 360°; B = 35°; C = 65°; D = 140°; E = 180°; F = 330°.

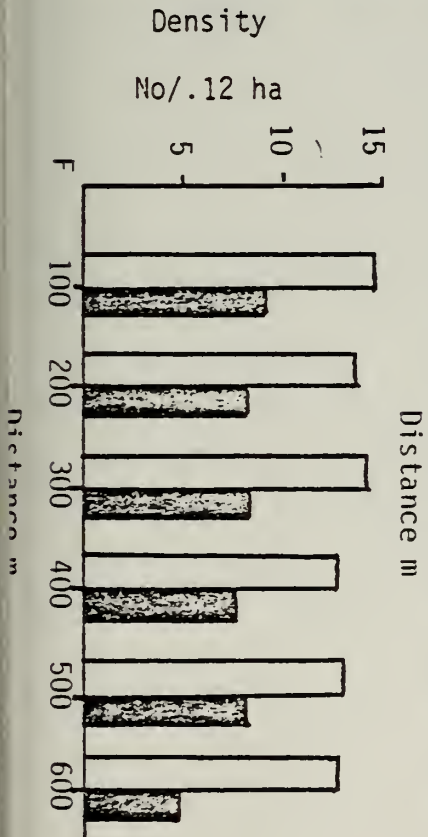
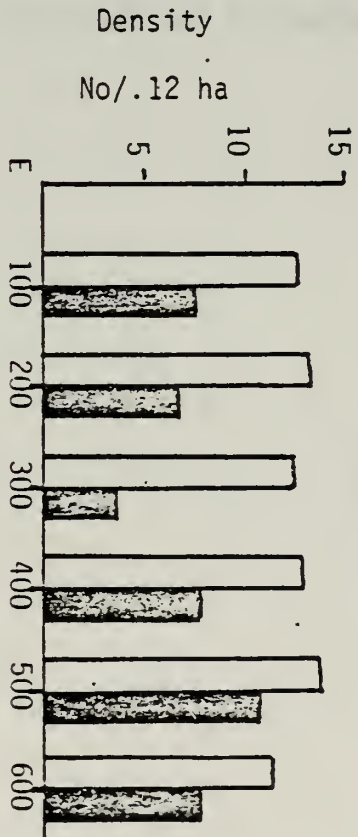
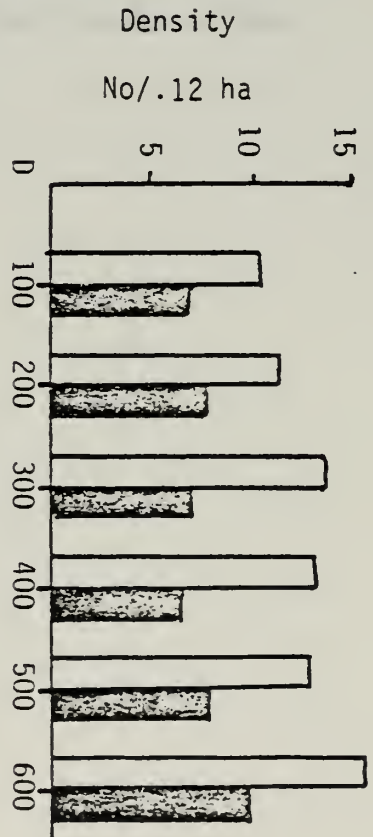
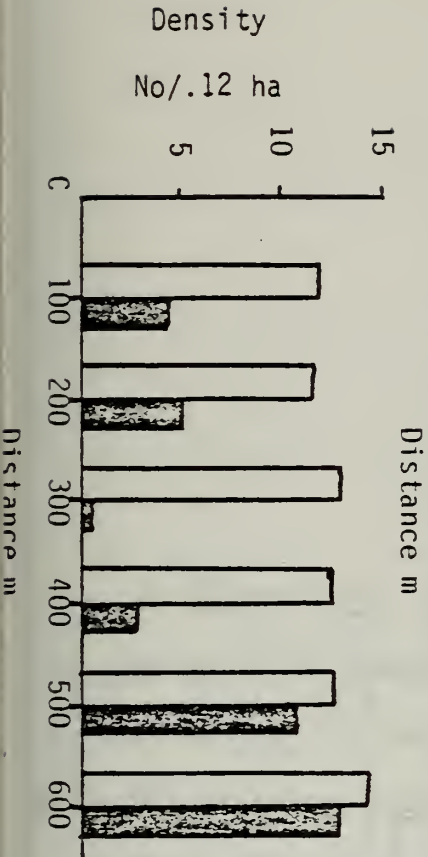
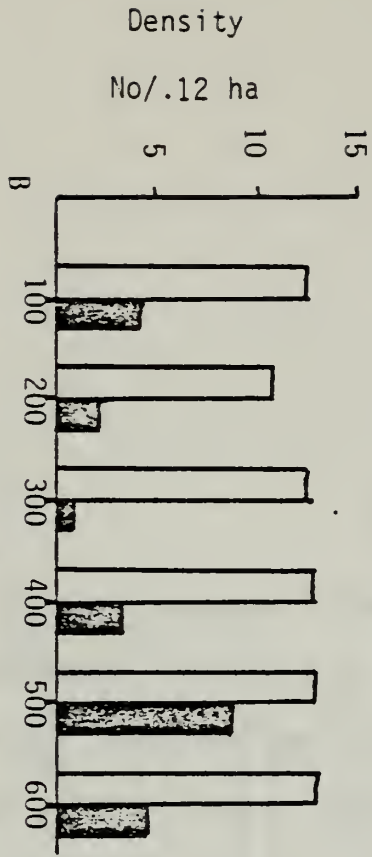
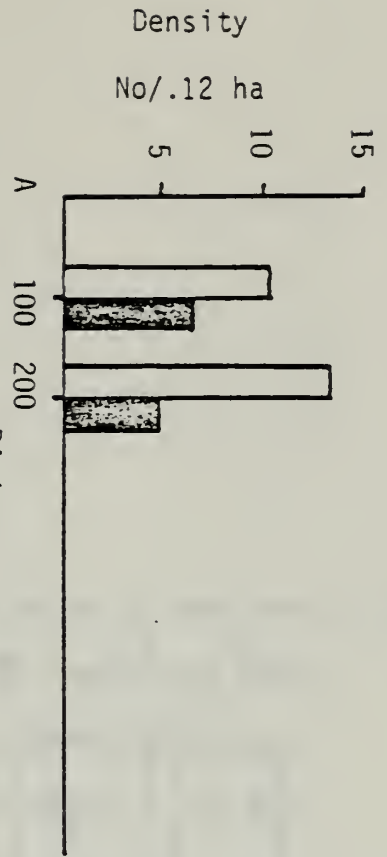
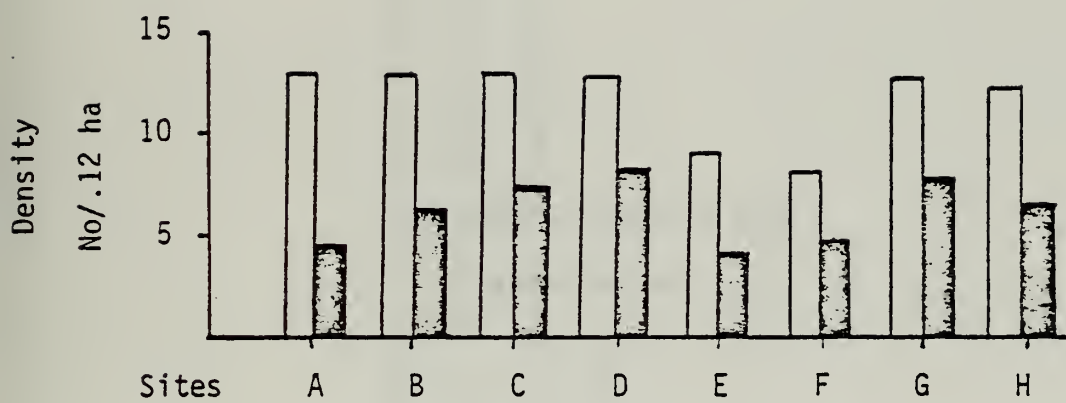


Figure 2. Mean density of perennial vegetation before (□ November 26, 1952) and after (■ May 28, 1977) establishment of a recreational pit area of Johnson Valley, T5N, R3E, SW¼ sec. 22, San Bernardino Base Line, California as determined from eight radiating transects placed at random compass degrees from the center of the pit area on aerial photographs. See Table 1.



Area 4 Afton Canyon

Kelso Dunes

Table 1. Density and cover means for perennial vegetation of recreational and off-road vehicle use areas of Afton Canyon, 61 km northeast of Barstow, San Bernardino County, California, T 10N, R 5E, Sec. 18. Ground transect plots (k) measured May 15, 1978 in creosote bush scrub.

Sites	K	N	Density no/ha	Cover m ² /ha
Hillside trails--test	32	128	314.97	128.17
Hillside trails--control	32	128	1424.67	546.75
Pit area--test	32	128	49.25	9.75
Pit area--control	32	128	1911.65	598.21

Table 2. Relative cover (% composition) and total percent cover of perennial vegetation in recreational and off-road vehicle use sites in Afton Canyon, 61 Km northeast of Barstow, San Bernardino County, California, T 10N, R 5E, Sec. 18. Ground measurements taken May 15, 1978.

Area 4 Afton Canyon		Relative Cover		
Creosote bush scrub		Sites		
Species		N	Control	Hillside trails
<i>Ambrosia dumosa</i>		13	57.21	9 6.26
<i>Atriplex y</i> <i>hemelytra</i>		12	1.45	
<i>Atriplex polycarpa</i>		6	1.09	6 3.21
<i>Coleogyne ramosissima</i>		3	.59	5 1.28
<i>Echinocactus ploycephalus</i>		2	.52	2 4.27
<i>Encelia virginensis</i>		1	.29	
<i>Haplopappus acradenius</i>				1 .54
<i>Larrea tridentata</i>		31	38.48	103 83.45
<i>Opuntia basilaris</i>		2	.15	2 .48
<i>Opuntia ramosissima</i>		1	.14	
<i>Petalonyx thurberi</i>		1	.07	

Total cover % 1.28 5.47

Table 3. Relative cover (% composition) and total percent cover of perennial vegetation in recreational and off-road vehicle use sites in Afton Canyon. Ground measurements taken May 15, 1978.

Area 4 Afton Canyon

Species	Relative Cover		
	N	Control	Pit Area
Creosote bush scrub			
<i>Ambrosia dumosa</i>	11	6.05	45 19.31
<i>Atriplex polycarpa</i>	13	3.08	5 1.19
<i>Cassia armata</i>	2	4.31	2 .53
<i>Coleogyne ramosissima</i>	3	1.95	12 6.65
<i>Encelia virginensis</i>			1 .14
<i>Ephedra nevadensis</i>	2	3.08	2 2.35
<i>Larrea tridentata</i>	86	80.10	57 68.04
<i>Stephanomeria pauciflora</i>	3	1.43	4 1.77

Total cover % 9.75 5.98 . . .

Figure 1. Bar graph of density (A) and cover (B) of perennial vegetation in creosote bush scrub at recreational vehicle use areas of Afton Canyon, 61 km northeast of Barstow, San Bernardino, California. (See Table 1).

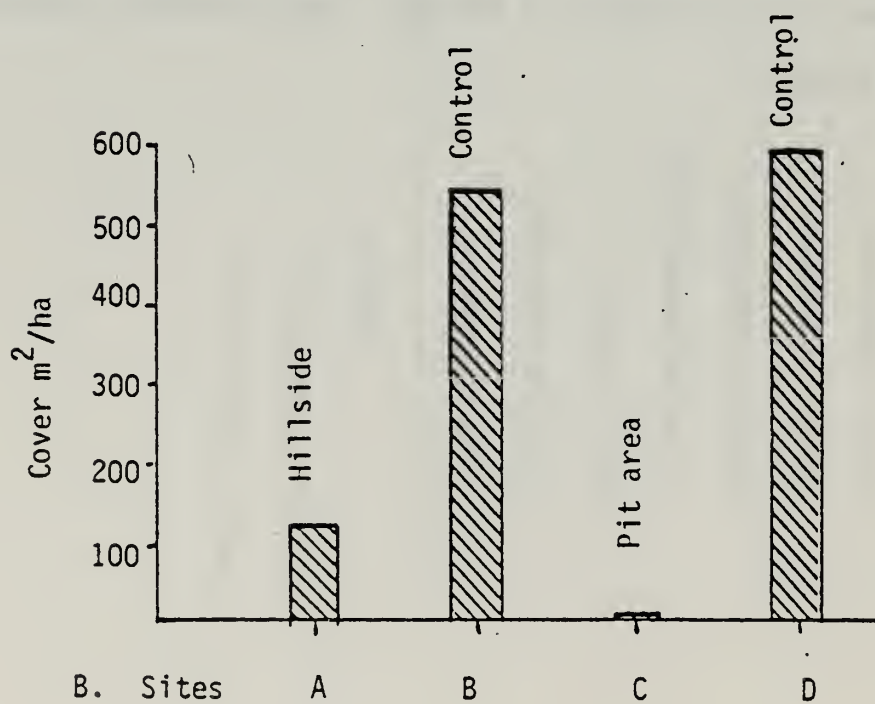
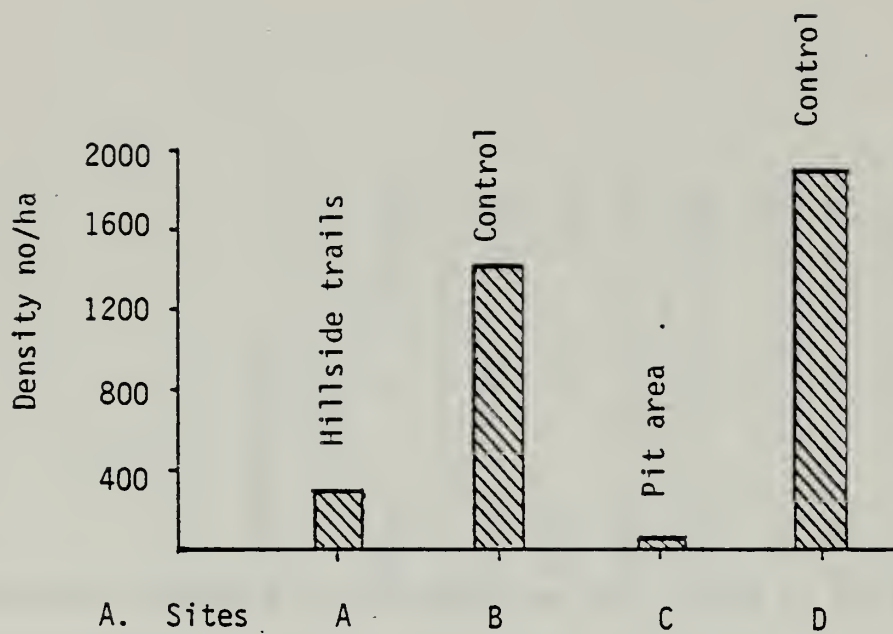


Table 1. Mean density no/.12 ha ($\bar{N}$) of perennial vegetation before (Apr. 15, 1953) and after (June 9, 1974) use by recreational vehicles in the Kelso Dunes, T10N, R12E, secs. 3 and 9, San Bernardino Base Line, California as determined from aerial photographs.

<u>Transect</u>	(K=90)	<u>N</u>	<u>Density no/.12 ha</u>			
			Desert floor		Foredune	
			<u>1953</u>	<u>1974</u>	<u>1953</u>	<u>1974</u>
1		1125	12.5			
2		560		6.2		
3		432			4.8	
4		253				2.8
5		1252	13.9			
6		621		6.9		
7		321			3.6	
8		176				1.9
9		659	7.3			
10		290		3.2		
11		386			4.3	
12		217				2.4
13		488	5.4			
14		250		2.8		

Table 2. Statistical summary of comparisons of mean values for density. in Kelso Dunes study sites.

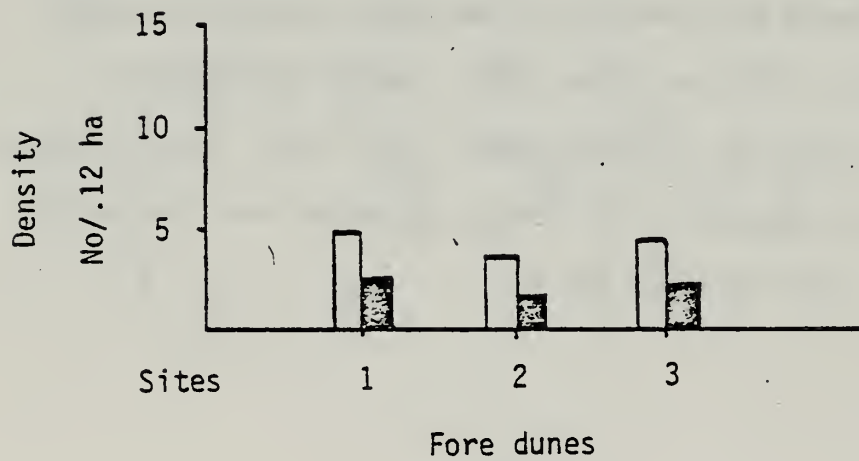
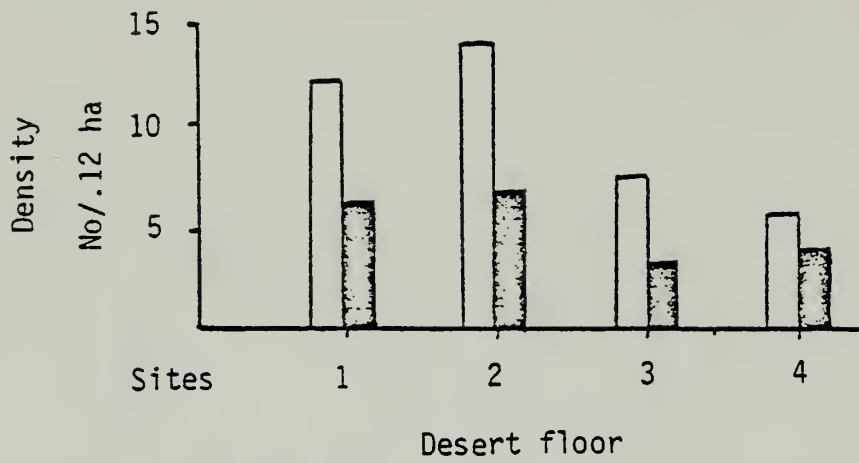
See Table 1 and Figure 1.

Sites

Values	Desert Floor		Foredune	
	1953	1974	1953	1974
$\bar{x}$	9.7	4.7	4.23	2.36
SD	4.07	2.07	.60	.45
Paired-t	4.95			21.16
DF	3			2
P	.015			.0022

	Desert Floor		Foredune	
$\bar{x}$	8.85		3.3	
SD	5.73		1.27	
Paired-t		1.76		
DF		1		
P				.33

Figure 1. Bar graph showing mean density of perennial vegetation before (□, Apr. 15, 1953) and after (■, June 9, 1974) use by recreational vehicles in Kelso Dunes, T10N, R12E, secs. 3 and 9, San Bernardino Base Line, California as determined from aerial photographs. See Tables 1 and 2.



Area 5 Plaster City

Table 1. Mean density, no/.04 ha ($\bar{N}$), of perennial vegetation before (May 18 and 26, 1953) and after (Nov. 26, 1972) establishment of recreational pit areas (sites 1-3) near Plaster City, California. Site 1 - T15S, R11E, SW $\frac{1}{4}$ sec. 15; Site 2 - T15S, R11E, SW $\frac{1}{4}$ sec. 4; Site 3 - T15S, R10E, SW $\frac{1}{4}$ sec. 1.

Site	Date	Transect	K	N	$\bar{N}$	$\Sigma \bar{N}$
1	1953	1	90	203	2.25	
		2	90	358	3.98	
		3	90	584	6.49	4.24
	1972	1	90	209	2.32	
		2	90	325	3.61	
		3	90	502	5.58	3.84
2	1953	1	90	414	4.6	
		2	90	518	5.76	
		3	90	577	6.41	5.59
	1972	1	90	228	2.53	
		2	90	457	5.08	
		3	90	533	5.92	4.51
3	1953	1	90	776	8.62	
		2	90	858	9.53	
		3	90	833	9.25	9.13
	1972	1	90	300	3.33	
		2	90	319	3.54	
		3	90	293	3.26	3.37

Table 2. Statistical summary of comparisons of mean density in study sites of Plaster City. See

Table 1 and Figure 2.

Sites

Values	Pit area 1						Pit area 2		Pit area 3	
	<u>1953</u>	<u>1972</u>	<u>1953</u>	<u>1972</u>	<u>1953</u>	<u>1972</u>	<u>1953</u>	<u>1972</u>	<u>1953</u>	<u>1972</u>
$\bar{x}$	4.24	3.8	5.59	4.51	9.13	3.37				
SD	2.13	1.64	.917	1.76	.46	.14				
Paired-t	1.42		2.17		24.70					
DF	2		2		2					
P	.29		.16		.0016					

Table 3. Mean density, no/.002 ha plot (K), of perennial vegetation in four selected racecourse sites of the El Cajon Motorcycle Club "coyote chase type" race held December 3, 1972 in the Yuha Desert near Plaster City, California. Sites: 1 - T15N, R11E, Sec. 18; 2 - T15S, R10E, SW $\frac{1}{4}$ sec. 24; 3 - T16S, R11E, sec. 15; 4 - T15S, R11E, sec. 21.

Density no/.002 ha

Racecourse Sites		1		2		3		4	
<u>Transects (K=720)</u>	<u>N</u>	<u>Raceway</u>	<u>Control</u>	<u>Raceway</u>	<u>Control</u>	<u>Raceway</u>	<u>Control</u>	<u>Raceway</u>	<u>Control</u>
1	960	.57	.79	.51	1.56	.83	3.4	1.37	1.64
2	1111	1.13	1.21	1.86	2.83	1.16	.99	1.48	1.69
3	1588	1.41	1.43	3.66	5.86	1.02	1.93	1.12	1.21

Table 4. Mean density, no/.04 ha plot (K), of perennial vegetation at the El Cajon Motorcycle Club racecourse site 1 (Table 3, Fig. 3) as determined from aerial photographs taken before (April 18, 1953 and Nov. 26, 1972) and after (Dec. 12, 1972) the race.

Racecourse Site 1		<u>Density no/.04 ha</u>			
		April 18, 1953	Nov. 26, 1972	Dec. 12, 1972	
Transects (K=90)	<u>N</u>	<u>control</u>	<u>control</u>	<u>raceway</u>	<u>transect mean</u>
1	592	6.58			
2	600	6.66			6.62
3	618		6.87		
4	542		6.02		6.44
5	448			4.97	
6	414			4.60	4.78

Table 5. Statistical summary of mean density in four raceway sites in the El Cajon motorcycle race of Dec. 3, 1972. See table 3.

Sites		
<u>Values</u>	<u>Raceway</u>	<u>Control</u>
$\bar{x}$	1.38	2.04
SD	.435	1.0
t		1.22
$n \rightarrow$ DF		4
P		.289

Table 6. Summary data of selected physical and biotic characteristics of the Dec. 3, 1972 El Cajon Motorcycle race as compiled from the 1973-1975 Bureau of Land Management race course rehabilitation report.

Item

Characteristics

A. Location

--In the Yuha Desert in Western Imperial County, Calif., 5.5 miles to the east of Ocotillo, 25 miles north of Mexico.

--T 16,16½,17S R 10,11E SBB&M.

B. Elevation:

--Range from 17 to 133 meters.

C. Geology:

--The Yuha Desert area contains hilly exposures of bedded fossiliferous sandstones, claystones, and shell reefs of the marine Imperial Formation overlain in some higher areas by Pliocene sandstones and clays, flanked by sandy alluvial slopes and surrounded by outwash plains and washes of western mountain areas.

D. Soils

--Associations:

-Rillito-Orita, Superstition-Acolita, Carrizo-Cajon = 72%.

-Rough Broken Land, Badlands = 28% -- exposed bedrock and concretions interspersed with small areas of shallow residual soil of coarse to fine sands.

Item

Characteristics--continued 1

--Surface Textures:

- Range from fine sandy loam on the terraces to coarse sand in the bottoms of washes.
- Most calcareous throughout and semi-hard lime concretions or layers throughout profile.

--After Race Effects:

- Fragile vesicular soil pavement was destroyed; depressed tracks may stay visible up to 30 years.
- Surface gravel and rock fragments depressed into soil or displaced to sides of the trails, tending to form rows between individual tracks.
- Results-Tracks leave discernible, often flour-like loose soil surface and provides for vulnerability to movement of fine soils by wind and water.

E. Vegetation:

--Three distinct communities of perennial plant species:

1. Dry sandy washes--Smoketree, Saltcedar, Desert Holly.
2. Gently sloping sandy alluvial fans and basins--as above plus,

Item

Characteristics--continued 2

3. Firmly paved terraces, most extensive--Creosote bush,

Bursage, with occasional Ocotillo plants

F. Race:

--215 motorcycles all starting at once on extended line.

--4 laps at 20.7 miles/lap.

--Date run--December 3, 1972.

Fig. 1. Outline map of the El Cajon Valley Motorcycle Racecourse (—) held December 3, 1972 in the Yuha Desert, Imperial County, California, showing study sites 1-4.

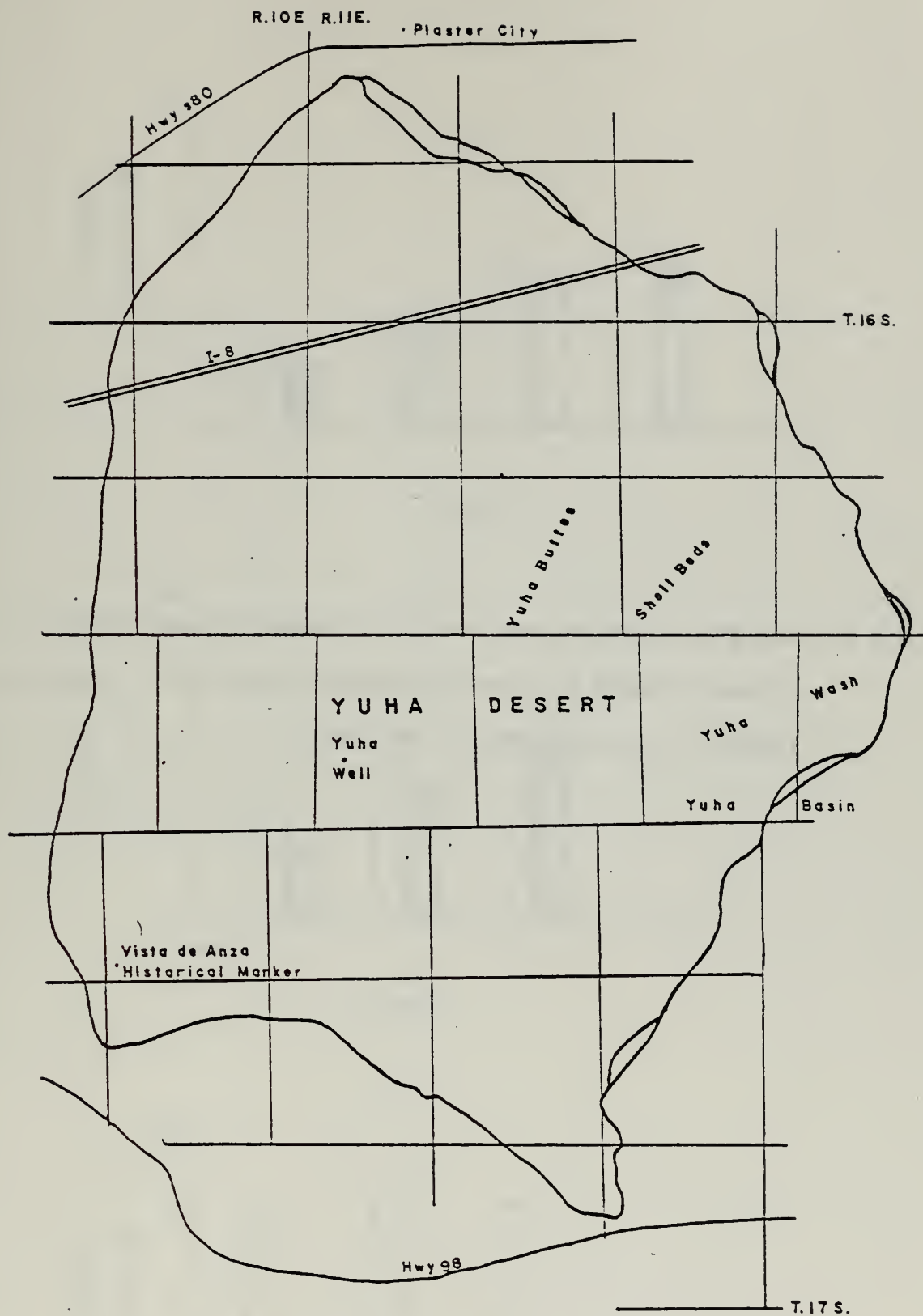


Figure 2. Bar graph showing mean density of perennial vegetation in transects taken at three recreational vehicle pit areas at Plaster City, California. See Table 1.

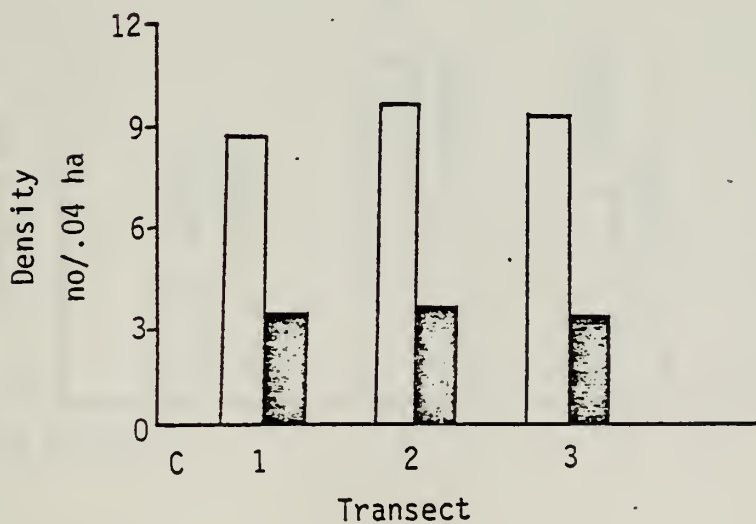
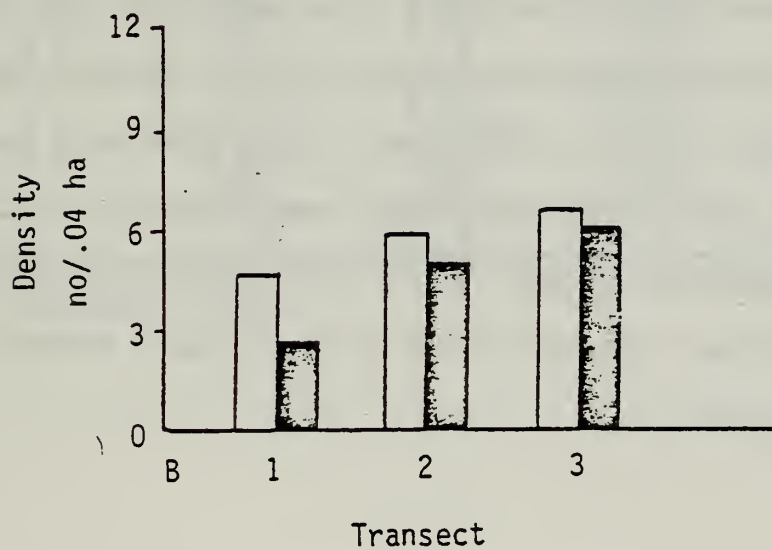
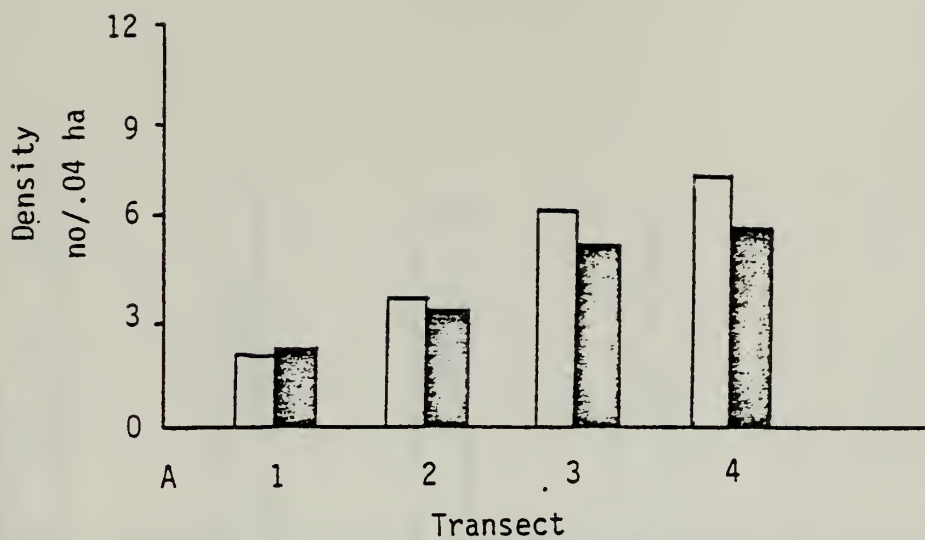
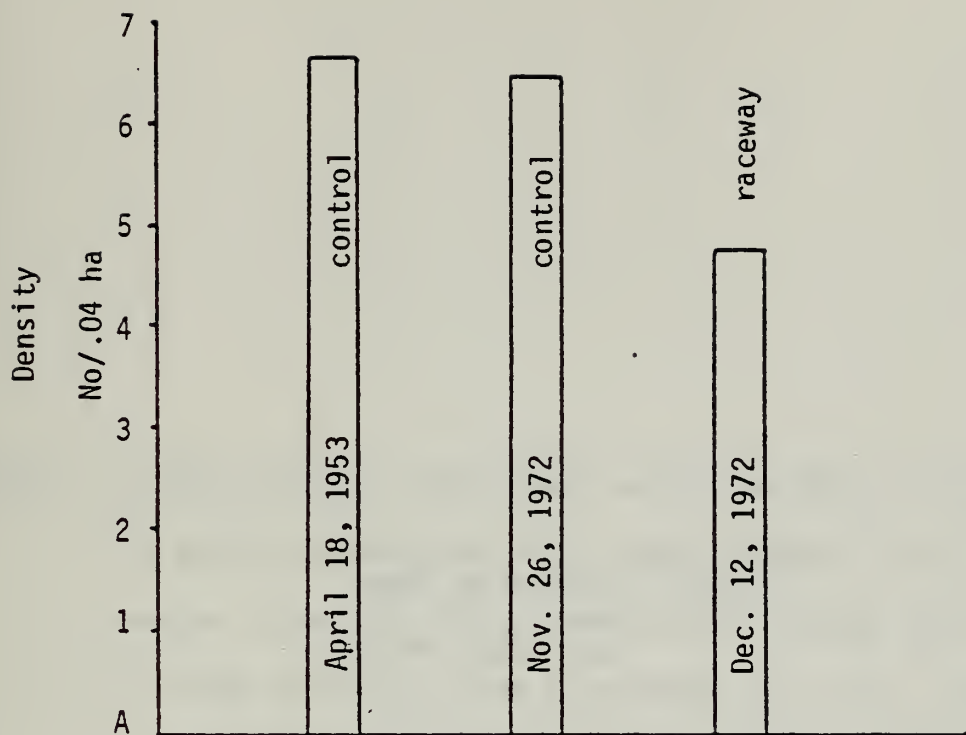
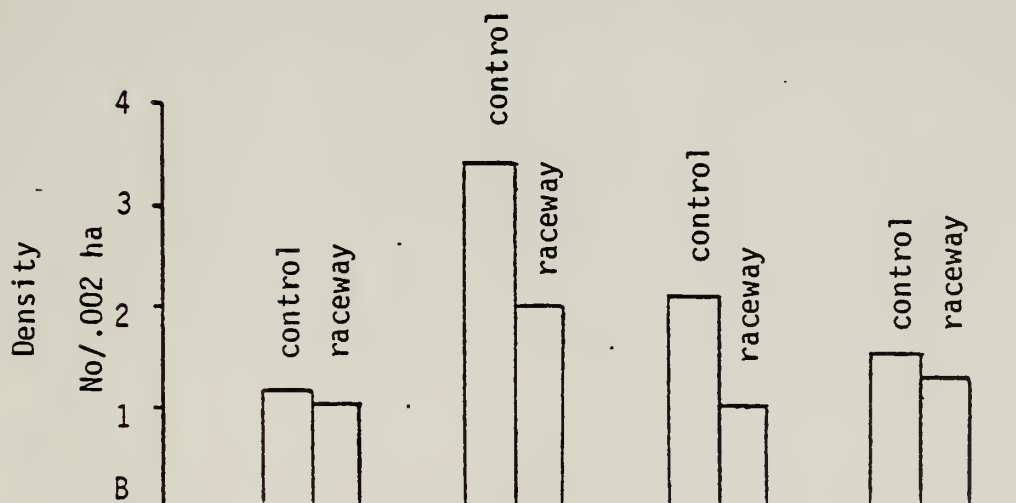


Figure 3. A. Bar graph showing mean density of perennial vegetation at racecourse site 1 (see Table 3) as determined from aerial photographs taken before (April 18, 1953 and Nov. 26, 1972) and after (Dec. 12, 1972) the El Cajon motorcycle race held Dec. 3, 1972 in the Yuha Desert near Plaster City, California. B. Comparison of mean density of perennial vegetation in control and racecourse sites of the El Cajon motorcycle race. (See table 3.)



Racecourse Site 1



Racecourse sites

Area 6 Barstow to Vegas

Motorcycle Race

Table 1. Summary data of point frame samples (N=1500) of vegetation in sandy creosote bush scrub taken December 11,12, 1977 at random sites (75) along transects (3) through the Barstow to Vegas Motorcycle Race of November 30, 1974. Transect sites through race path located at site 2, T.11N, R.4E, Sec.10, and pit area at site 1, T.10N, R.4E, Sec.6, San Bernardino Base Line, San Bernardino County, California.

Transect Data Summaries

Transects

	<u>Pit Area</u>	<u>Racepath-Dense Tracks</u>	<u>Racepath-Sparse Tracks</u>
No. sites on transect line	25	25	25
Average random distance between sites - m	3.2	4.6	43
No. sites with tracks	25	21	7
No. tracks at sites	45	38	10
Average width of tracks - cm	18.5	13.8	17.1
Average depth of tracks - cm	2.5	.5	.6
Cover %			
	in tracks	in tracks	in tracks
	out of tracks	out of tracks	out of tracks
n	320	192	61
	180	308	439
Foliage	37.1	26.5	31.1
	15	46.4	30.9
Sand	32.5	62.5	45.9
	74.4	49	61.2
Litter	30.3	10.9	22.9
	10.9	4.5	7.7

Table 2: Photo analysis of perennial vegetation on aerial photographs of the November 30, 1974 Barstow to Vegas Motorcycle Race showing density ($\bar{N}$) and cover (%) before (Nov. 26, 1974) and after (Dec. 5, 1974) the race.

Site	Location		Date	K	N	Density	% Cover
3	T 11N	R 4E Sec. 10	Nov. 26, 1974	104	1581	23.11	
				32	325		16.13
			Dec. 5, 1974	64	831	12.5	
				32	274		13.65
4	T 11N	R 4E Sec. 17	Nov. 26, 1974	120	2015	29.46	
				19	207		17.98
			Dec. 5, 1974	66	934	13.65	
				24	203		17.44

Table 3. Summary data from selected sites of the November, 1974 Barstow to Las Vegas Motorcycle Race as compiled from the 1974 and 1975 Bureau of Land Management impact and evaluation race reports. Percent increase in number of tracks and percent decrease in vegetation refer to tests run immediately before and after the race.

Summary Data

ESP

Site	Plant	Topography	Soil	% Increase	% Vegetation
Number	Association		Association	Tracks	Decrease

1 Pit Area	Creosote scrub	Low sandy hill	Mojave-Adelanto	470*	15 ESP-1
2 Race Start	Creosote scrub	Bajada-gentle slope	Mojave-Adelanto	289	20 ^{1 2}
8 Race Course	Alkali Sink	Playa	Rosamond-Playa	72	27 ⁸
11A Race Course	Creosote Scrub	Bajada-Steeper up slope	Anthony-Cajon-Arizo	41	20 ^{11A}
13 Race Course	Cheesebush	Wash	Anthony-Cajon-Arizo	81	3 ¹³
21 Race Course	Alkali sink-lake edge	Playa	Rosamond-Playa	106	3 ²¹
26 Finish Area	Creosote scrub	Flats	Anthony-Cajon-Arizo	841	76 ²⁶

* corrected value

Table 4. Density and cover means for perennial vegetation in racecourse and control of site 4, T 12N R 4E Sec 17 and site 5, T 12N R 5E Sec 28, San Bernardino County, California of the Nov. 26, 1974 Barstow to Vegas Motorcycle Race.

Site	K	N	Density no/ha	Cover m ² /ha
4--Racecourse	32	128	1402.53	165.15
4--Control	32	128	2688.16	508.86
5--Racecourse	30	120	1779.35	443.49
5--Control	36	144	2427.19	1425.75

Table 5 . Statistical summary of comparison of mean values for density
at raceway sites 3 and 4 (see Table 6 and Figure 4) of the
Barstow to Vegas Motorcycle Race.

<u>Values</u>	<u>Sites</u>	
	<u>Raceway</u>	<u>Control</u>
$\bar{X}$	13.07	26.28
SD	.81	4.48
t		4.09
DF		1
P \		.152

Table 6. Relative cover (% composition) and total percent cover of perennial vegetation at racecourse site 5 of the Barstow to Vegas Motorcycle Race of Nov. 30, 1974 as determined from ground measurements taken Jan. 22, 1978 at T.2N, R.5E, Sec.28, San Bernardino County, California.

Area 6 Barstow Vegas Motorcycle Race

Relative Cover

Creosote Bush Scrub

Sites

Species

N Control N Raceway

Ambrosia dumosa

77 18 99 48

Atriplex hymenelytra

1 1

Coleogyne ramosissima

2 2

Ephedra nevadensis

4 3

Hilaria rigida

22 6 5 1

Larrea tridentata

23 70 19 47

Lycium cooperi

3 3

Opuntia echinocarpa

1 1

Total cover % 5.09 1.65

Area 6. Barstow to Vegas Motorcycle Race

Relative Cover

Creosote bush scrub

Sites

<u>Species</u>	<u>Pit Area</u>		<u>Racepath-dense Tracks</u>		<u>Racepath-Sparse Tracks</u>	
	In tracks	Out of tracks	In tracks	Out of tracks	In tracks	Out of tracks

Annuals

Bouteloua barbata

37.8 37 96 70.6 94.7 48.5

Pectis papposa

57.9 59.2 5.1

Aggregate

4.9 3.7 3.9 5.2 3.6

Perennials

Ambrosia dumosa

17.4 13.3

Hilaria rigida

14.7

Larrea divaricata

11.8 14.7

Total cover % 37.1 . . .15 26.5 . . . 46.4 31.1 . . . 30.9 .

Area 6 Barstow to Vegas Motorcycle Race

Cheesebush scrub

Species	Relative Cover			
	Sites			
	N	Control	N	Raceway
<i>Ambrosia dumosa</i>	29	15	16	9
<i>Brickellia incana</i>			5	8
<i>Ephedra nevadensis</i>	21	16	10	9
<i>Hymenoclea salsola</i>	81	63	74	63
<i>Larrea tridentata</i>	2	3	1	1
<i>Lepidium fremontii</i>	5	1	6	4
<i>Lycium cooperi</i>			3	4
<i>Petalonyx thurberi</i>	4	1	4	1
<i>Stephanomeria pauciflora</i>	1	1	1	1
Total cover %	14.26	4.43		

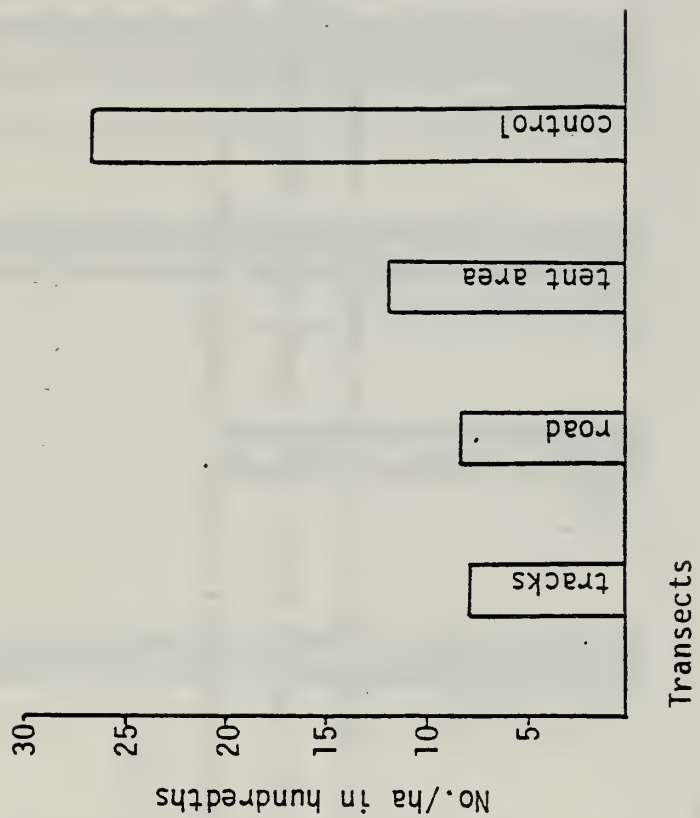


Fig. 6. Bar graph showing density, no/ha of perennial vegetation in transect sites of the General Patton WWII camp, T10N, R21E, Sec. 18, San Bernardino County, California, transects taken Dec. 18, 1977 and Mar. 19, 1978.

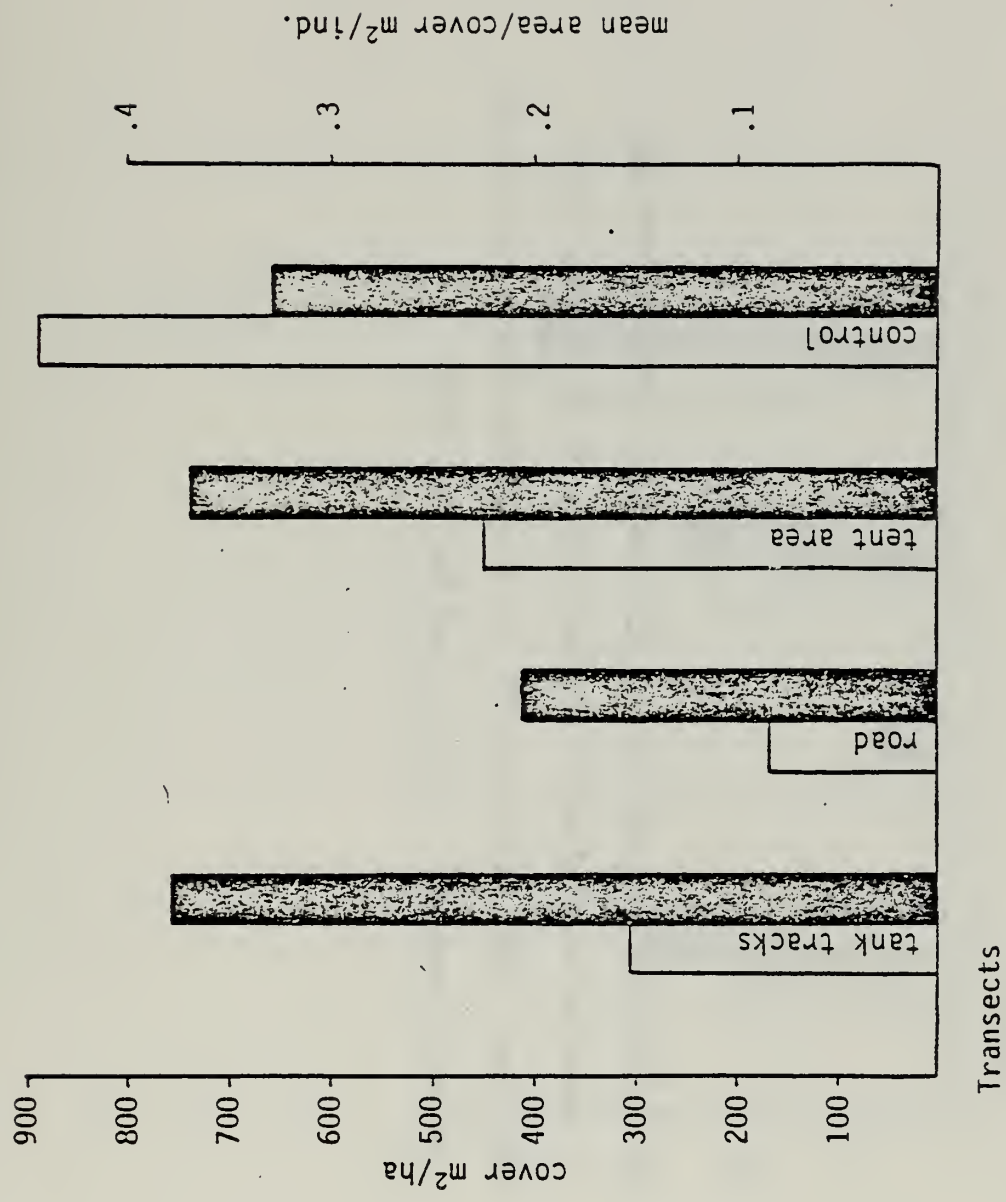


Fig. 5. Bar graph showing cover, m²/ha (□) and mean cover, m²/ind (■) of perennial vegetation in transect sites of the General Patton WWII camp, T10N, R21E, Sec. 18, San Bernardino County, California, transects taken Dec. 18, 1977, and Mar. 19, 1978.

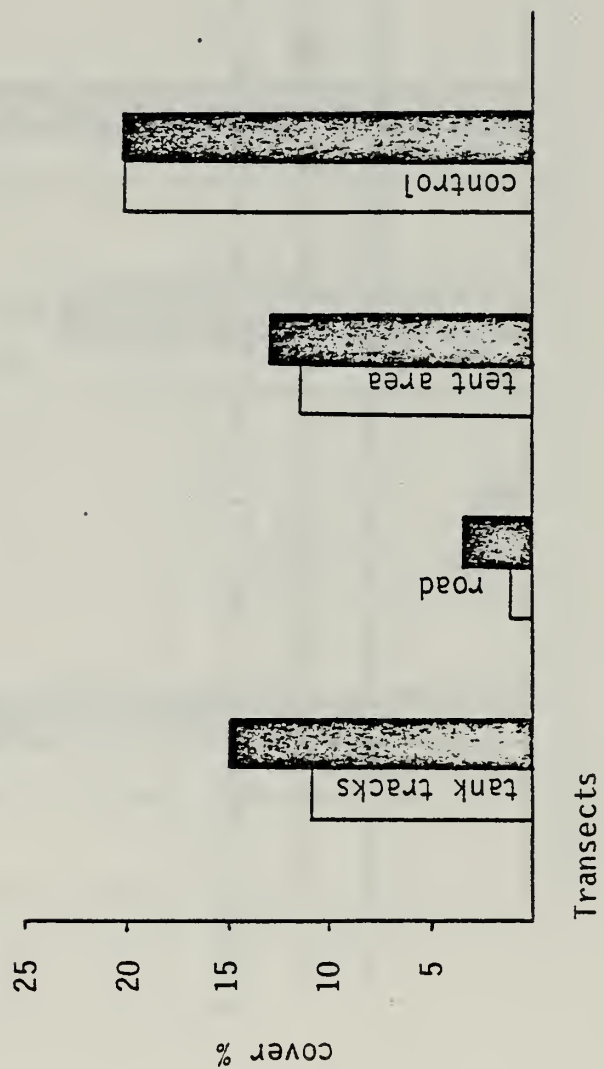


Fig. 4. Bar graph showing mean percent cover as determined from line transects of aerial photographs taken in 1953 (□) and in 1974 (■) in General Patton's WWII camp, T10N, R21E, Sec. 18, San Bernardino County, California.

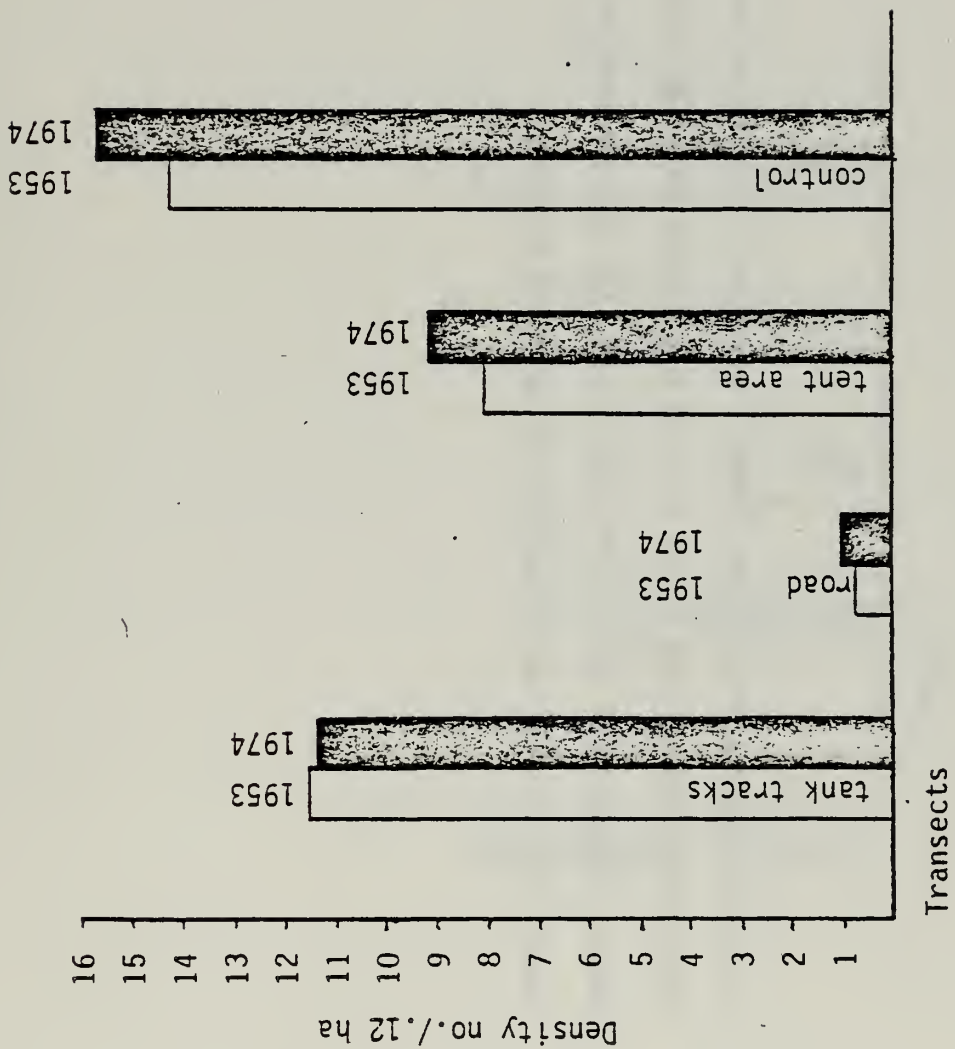


Fig. 3. Bar graph showing density no/.12ha of perennial vegetation measured from aerial photographs taken in 1953 (□) and in 1974 (■) of the General Patton WWII camp, T10N, R21E, Sec. 18, San Bernardino, County, California, approximately 32 Km NW of Needles.

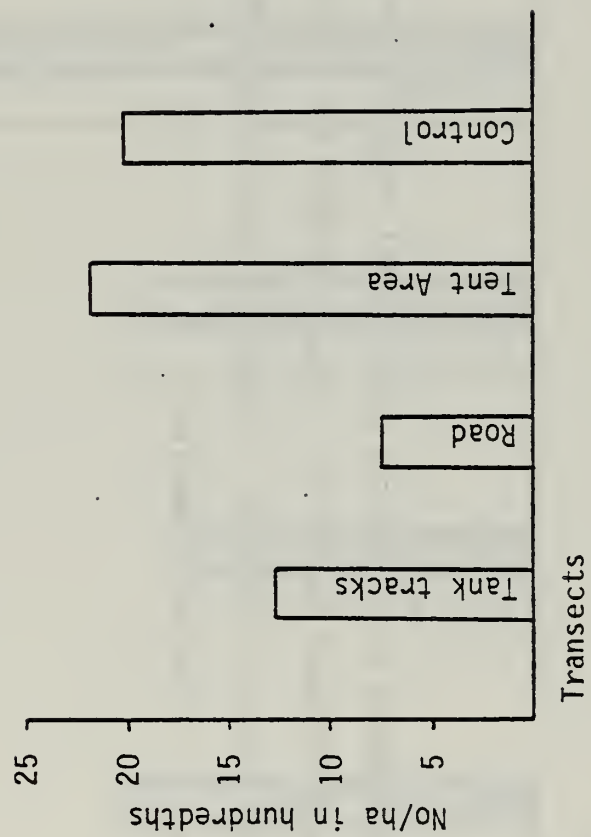


Fig. 2. Bar graph showing density no/ha of perennial vegetation in transect sites of the General Patton WWII camp, T10N R21E Sec. 18, San Bernardino County, California. Transects taken January 29, 1978 approximately 32 Km NW of Needles.

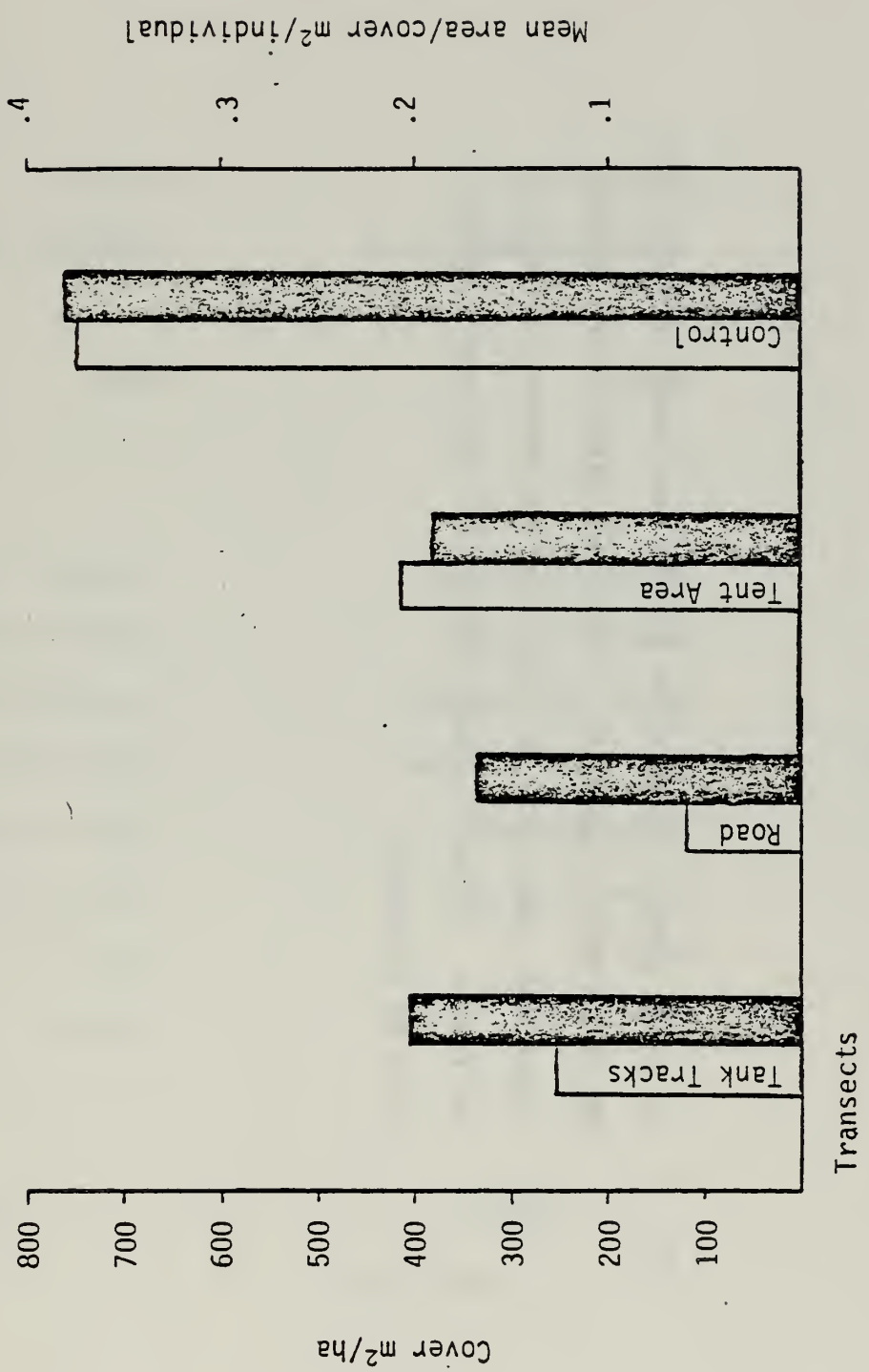


Fig. 1. Bar graph showing cover m²/ha (□) and mean cover m²/individual (■) of perennial vegetation in transect sites of the General Patton WWII camp, T10N R21E Sec. 18, San Bernardino County, California. Transects taken January 29, 1978 approximately 32 Km NW of Needles.

SUMMARY DATA

Needles

Essex

Sites

Physiognomic

Characteristics

Elevation

Slope/aspect

Parent rock

Land form

Surface conditions

Consistency

Very, Moist, Wet

Texture

Surface

Subsurface

Structure

Surface

Subsurface

2020 ft.

2-3% NW

mixed alluvium

alluvial fan

90% gravel-pavement

Soft, very friable

Slightly sticky

Slightly plastic

L

VGRS

moderate, med. platy

single grain

1680 ft.

1% SE

mixed alluvium

alluvial plain

80-90% gravel-pavement

Slightly hard, very friable

Slightly sticky

Slightly plastic

L

GrSL

moderate, med. platy

massive

Table 7. Table of summary data of physiognomic characteristics for
General Patton's WWII camps approximately 9 km N of Essex
and 32 km NW of Needles, San Bernardino County, California.
Analysis by AI Endo.

Area 7 Needles		Relative Cover						
Creosote bush scrub		Sites						
Species	N	Control	N	Tent area	N	Tank tracks	N	Roadway
Ambrosia dumosa	73	26.94	105	52.34	69	23.08	84	45.08
Brickellia incana			17	13.57			29	21.87
Coleogyne ramosissima	2	.33			8	4.47		
Echinocactus polycephalus			1	.31				
Eriogonum fasciculatum			2	2.16				
Hymenoclea salsola					1	.04	1	2.1
Larrea tridentata	51	71.89	16	31.01	47	68.91	12	30.64
Lycium cooperi			1	.37				
Opuntia ramosissima	2	.84			3	3.50		
Stephanomeria pauciflora			2	.24			2	.31
Total cover %		7.47		4.15		2.65		1.19

Table 6: Relative cover (% composition) and total percent cover of perennial vegetation at General Patton's WWII camp, Needles, San Bernardino County, California, T 10N, R 21E, Sec. 18. Ground measurements taken Jan. 29, 1978.

Area 7 Essex

Relative Cover

Creosote bush scrub

Sites

Species	N	Control	N	Tent area	N	Tank Tracks	N	Roadway
---------	---	---------	---	-----------	---	-------------	---	---------

Ambrosia dumosa

95	41.26	86	42.99	19	11.70	74	53.75
----	-------	----	-------	----	-------	----	-------

Coleogyne ramosissima

				2	.22		
--	--	--	--	---	-----	--	--

Larrea tridentata

32	54.72	49	56.79	94	86.94	22	46.25
----	-------	----	-------	----	-------	----	-------

Opuntia basilaris

				2	.18		
--	--	--	--	---	-----	--	--

Opuntia ramosissima

				3	.95		
--	--	--	--	---	-----	--	--

Stephonmeria pauciflora

1	4.01	1	.22				
---	------	---	-----	--	--	--	--

Total cover % 8.93 4.49 3.07 1.7 . . .

Table 5: Relative cover (% composition) and total percent cover of perennial vegetation at General Patton's WWII camp, Essex, San Bernardino County, California, T 8N, R 16E, Sec. 15. Ground measurements taken Dec. 18, 1977 and Mar. 19, 1978.

Site	K	N	Density no/.12 ha		Cover %	
			1953	1974	1953	1974
Tank tracks	120	985	8.21			
	120	968		12.23		
	50	86			10.97	
	50	91				12.23
Roadway	120	177	1.47			
	120	219		1.82		
	100	14			.77	
	100	33				2.31
Tent area	120	1027	7.20			
	120	864		8.56		
	50	62			7.22	
	50	85				10.76
Control	120	1278	10.65			
	120	1276		10.60		
	50	134			18.06	
	50	147				19.77

Table 4. Aerial photo analysis of 1953 and 1974 series photographs showing density, no/. 12 ha, and mean percent cover of perennial vegetation in General Patton's WWII camp, approximately 4.5 Km north of Essex, San Bernardino County, California, T 8N, R 17E, Sec. 21 (tracks) and T 8N, R 16E, Sec. 11 (all other sites).

Site	K	N	Density no/.12 ha Cover %			
			1953	1974	1953	1974
Tank tracks	120	1374	11.45			
	120	1352		11.27		
	50	87			10.93	
	50	115				15.09
Roadway	120	78	.65			
	120	121		1.01		
	104	14			1.36	
	104	41				3.48
Tent area	120	975	8.12			
	120	1100		9.17		
	50	76			11.53	
	50	102				13.31
Control	120	1708	14.23			
	120	1891		15.76		
	50	137			20.13	
	50	144				20.19

Table 3. Aerial photo analysis of 1953 and 1974 series photographs showing density, no/.12 ha, and mean percent cover in General Patton's WWII camp, approximately 32 Km northwest of Needles, San Bernardino County, California, T 11N; R 20E, Sec. 28 (tracks), T 10N, R 21E, Sec. 18 (roadway and tent area) and T 10N, R 20E, Sec. 20 (control).

Site	K	N	Density no/ha	Cover m ² /ha
Tank tracks	32	128	1290.7	264.6
Roadway	32	128	744.5	118.9
Tent area	36	144	2196.3	414.7
Control	32	128	2032.3	746.9

Table 2. Density and cover means for perennial vegetation in General Patton's WWII camp, approximately 32 Km northwest of Needles, San Bernardino County, California, T 10N, R 21E, Sec. 18. Ground transect plots (k) measured Jan. 29, 1978 in creosote bush scrub.

Site	K	N	Density no/ha	Cover m ² /ha
Tank tracks	30	120	803.1	307.4
Roadway	24	96	820.4	170.3
Tent area	34	136	1202.2	449.4
Control	32	128	2644.7	892.6

Table 1. Density and cover means for perennial vegetation in General Patton's WWII camp approximately 4.5 Km north of Essex, San Bernardino County, California, T8N, R17E, Sec. 21 (tracks) and T8N, R16E, Sec. 11 (all other sites). Ground transect plots (k) measured Dec. 18, 1977 and Mar. 19, 1978 in creosote bush scrub.

Area 7 General Patton's Camps
Essex and Needles

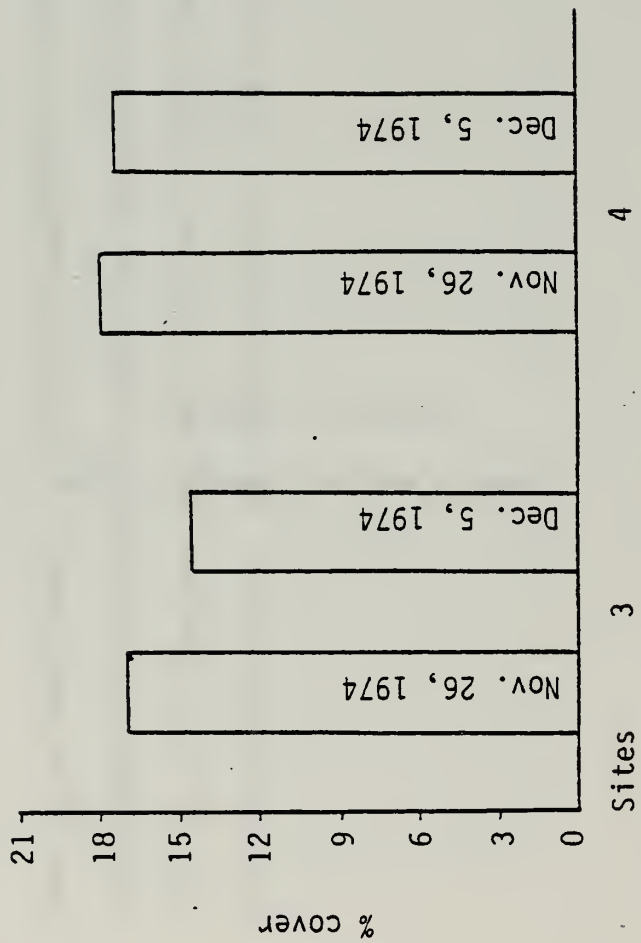


Fig. 6. Bar graph showing mean percent cover as determined from line transects ($K=107$, $N=1009$) of aerial photographs before (Nov. 26, 1974) and after (Dec. 5, 1974) the November 30, 1974 Barstow to Vegas Motorcycle Race.

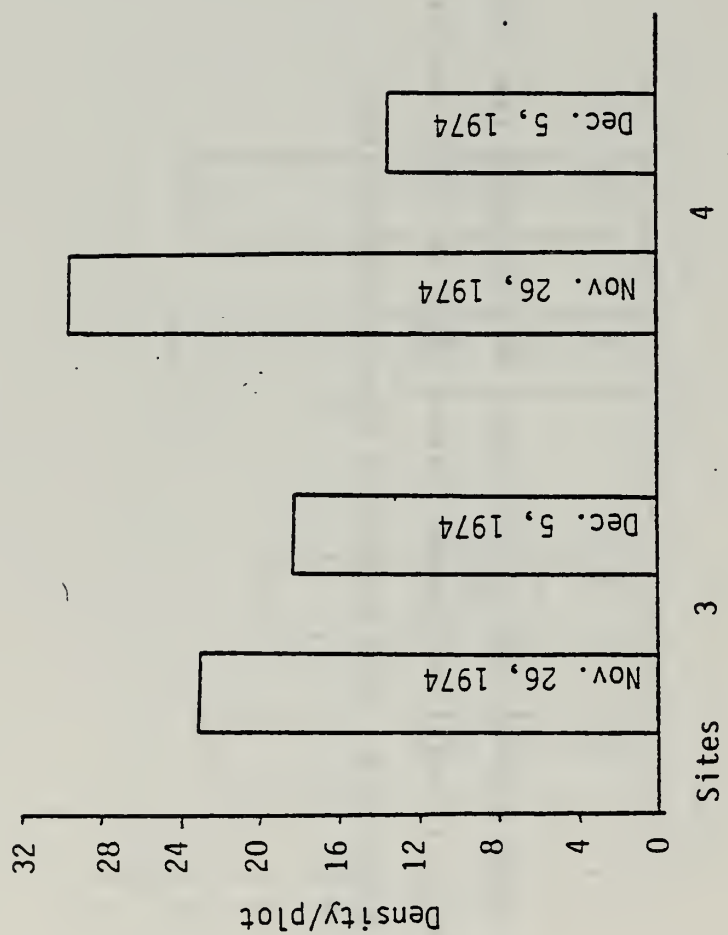


Fig. 5. Bar graph showing mean density per .01 ha plot in two raceway sites of the Barstow to Vegas Motorcycle Race of November 30, 1974 as determined from quadrat measurements on $2\frac{1}{4} \times 2\frac{1}{4}$ inch aerial color photograph negatives taken before (Nov. 26, 1974) and after (Dec. 5, 1974) the race. Site 3, Dec. 5, 1974 includes Hilaria rigida where Fig. 4 does not.

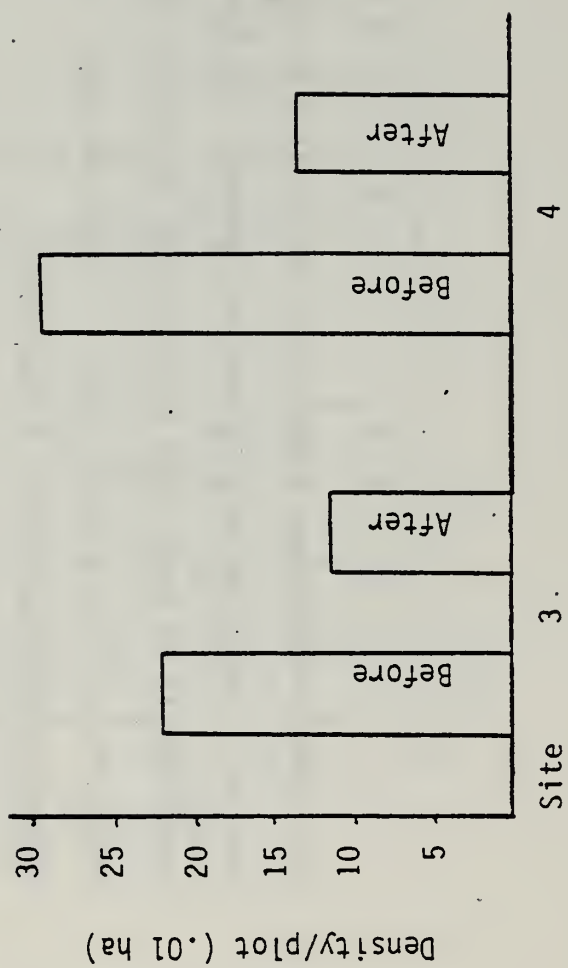


Fig. 4. Bar graph showing mean density per .01 ha plot in two raceway sites of the Barstow to Vegas Motorcycle Race of November 1974 as determined from quadrat measurements ($K=354$, $n=6;841$) on $2\frac{1}{4} \times 2\frac{1}{4}$ inch aerial color photograph negatives taken before (Nov. 26, 1974) and after (Dec. 5, 1974) the race.

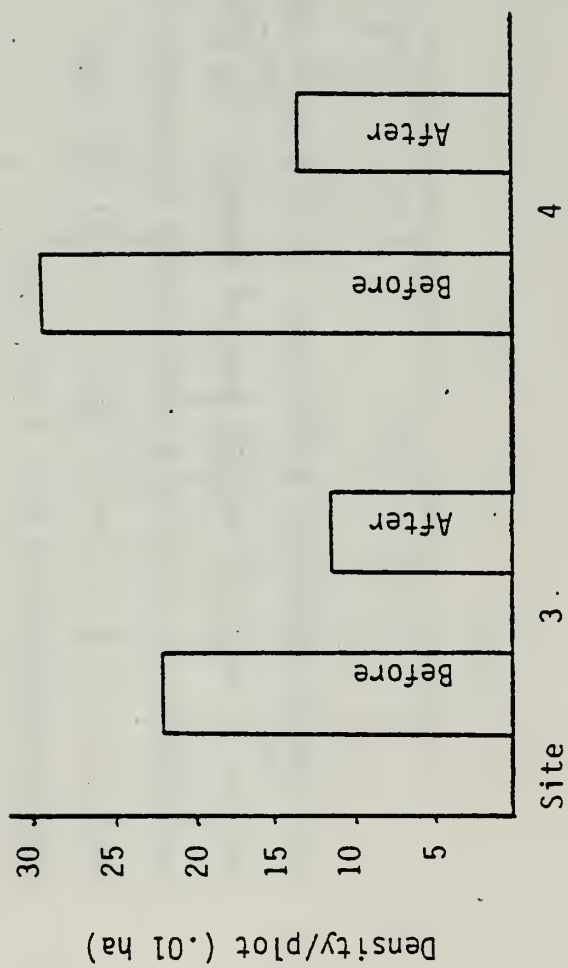


Fig. 4. Bar graph showing mean density per .01 ha plot in two raceway sites of the Barstow to Vegas Motorcycle Race of November 1974 as determined from quadrat measurements ($K=354$, $n=6;841$) on $2\frac{1}{4} \times 2\frac{1}{4}$ inch aerial color photograph negatives taken before (Nov. 26, 1974) and after (Dec. 5, 1974) the race.

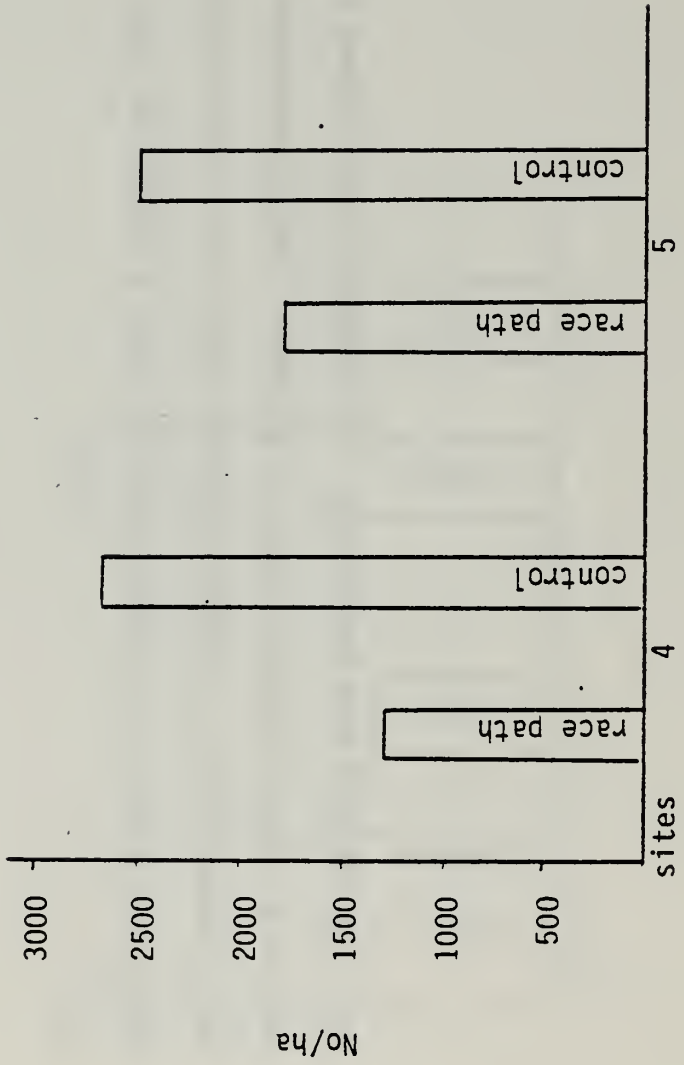


Fig. 3. Bar graph of density No/ha of perennial vegetation at two sites of the Barstow to Vegas Motorcycle Race of November 30, 1974. Transects taken January 22, 23, 1978 at T. 11N R. 4E Sec. 17 and T. 12N R. 5E Sec. 28, San Bernardino County, California, for sites 4 and 5 respectively.

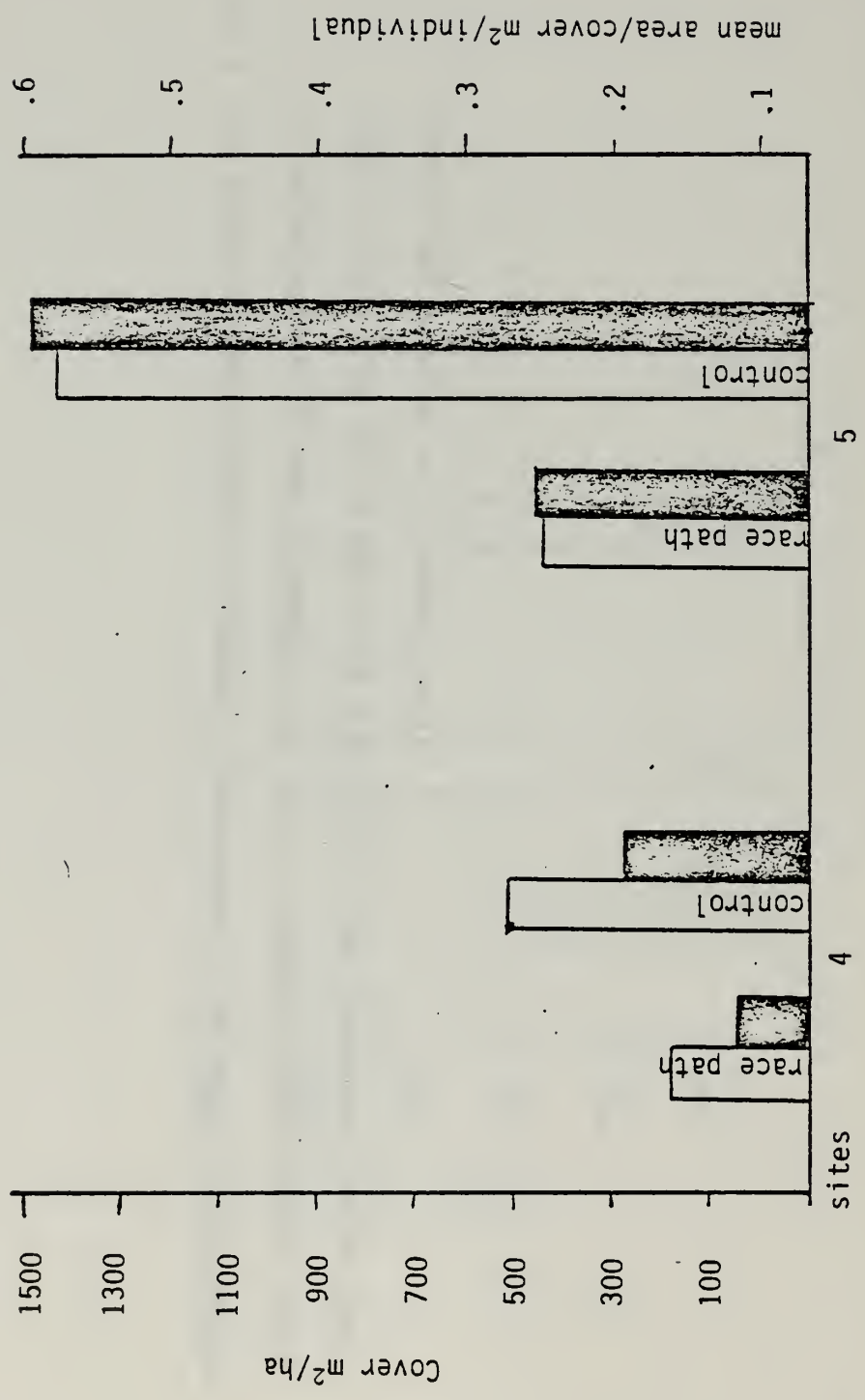


Fig. 2. Bar graph of cover m^2/ha () and mean cover $m^2/individual$ () of perennial vegetation at two sites of the Barstow to Vegas Motorcycle Race of November 30, 1974. Transects taken January 22, 23, 1978 at T.11N R.4E Sec.17 and T.12N R.5E Sec.28, San Bernardino County, California for sites 4 and 5 respectively.

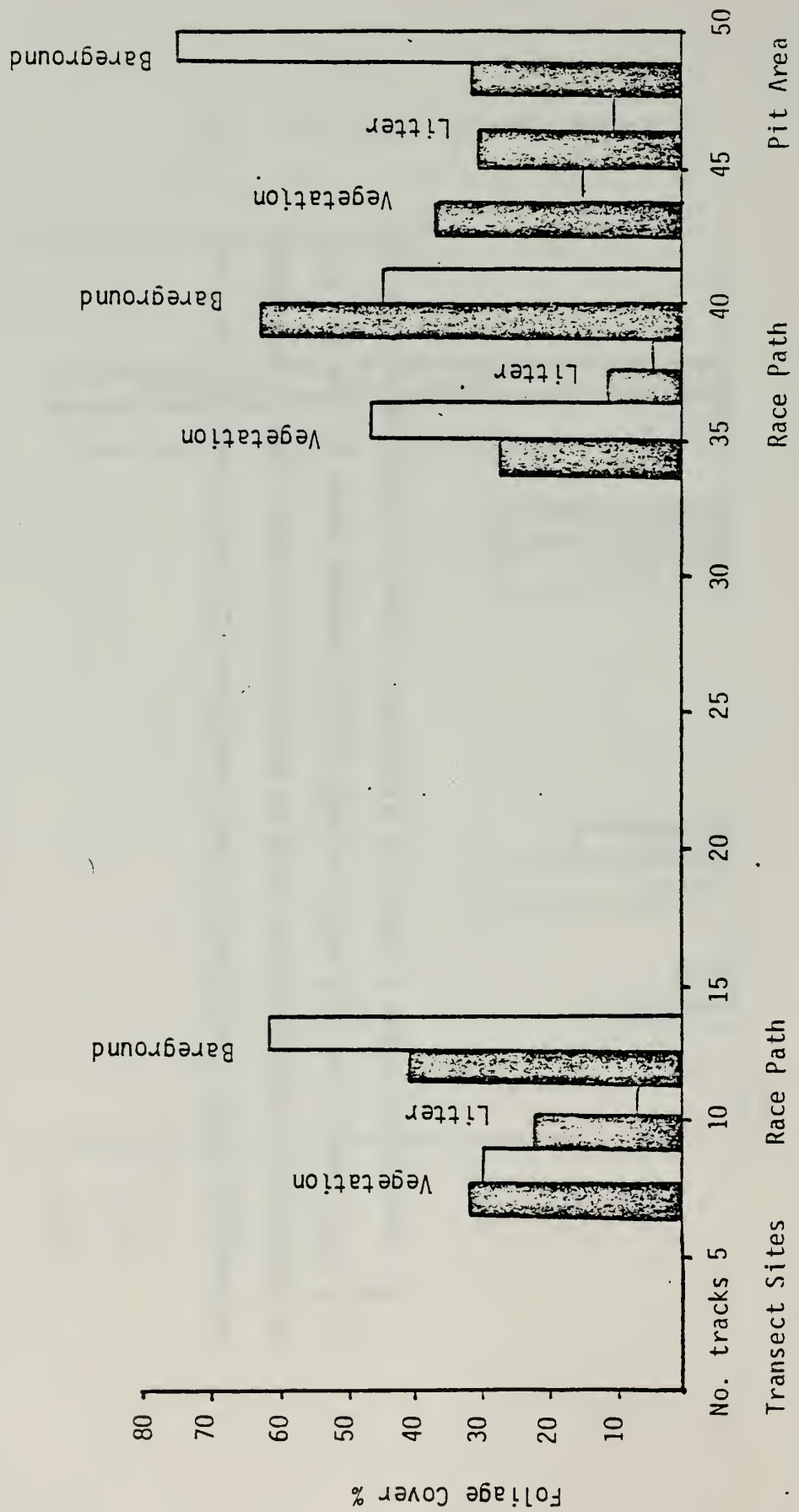


Fig. 1. Bar graph showing vegetation, litter, and bareground cover (%) in () and out () of tracks at the Barstow to Vegas Motorcycle Race of November 30, 1974.

Fig. 7. Bar graph showing density, no./12 ha of perennial vegetation measured from aerial photographs taken in 1953 ($\square$) and in 1974 ($\blacksquare$) of the General Patton WWII camp, T10N, R21E, Sec. 18, San Bernardino County, California, approximately 9 km NW of Essex.

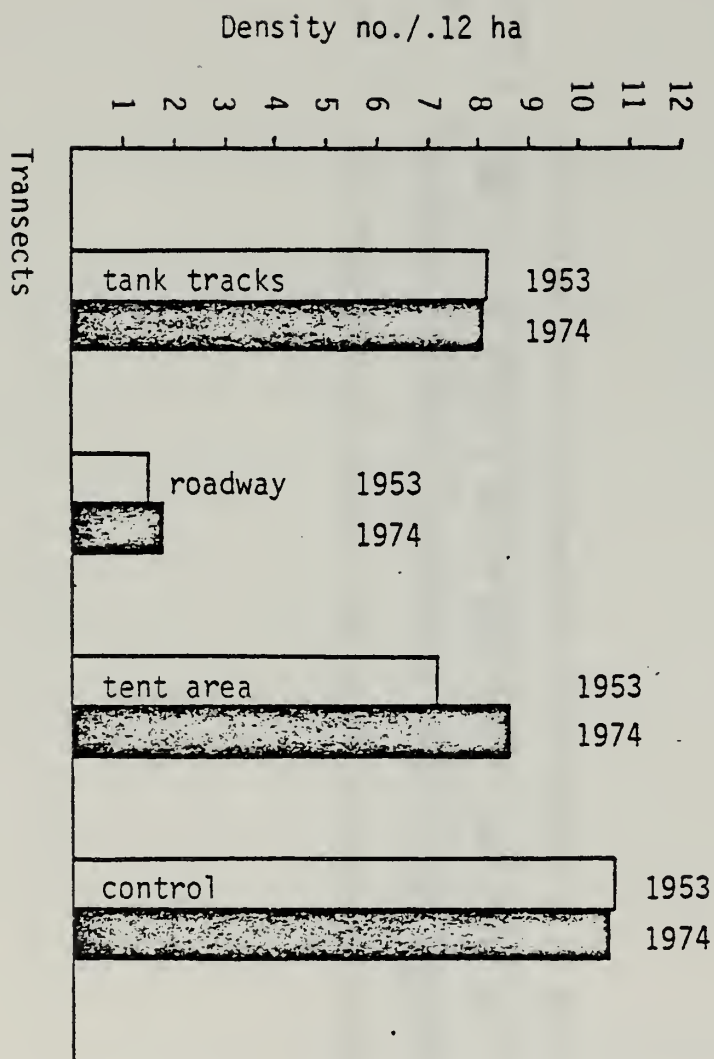


Fig. 8. Bar graph showing mean percent cover as determined from line transects of aerial photographs taken in 1953 (□) and in 1974 (■) in General Patton's WWII training area approximately 9 km NW of Needles, California.

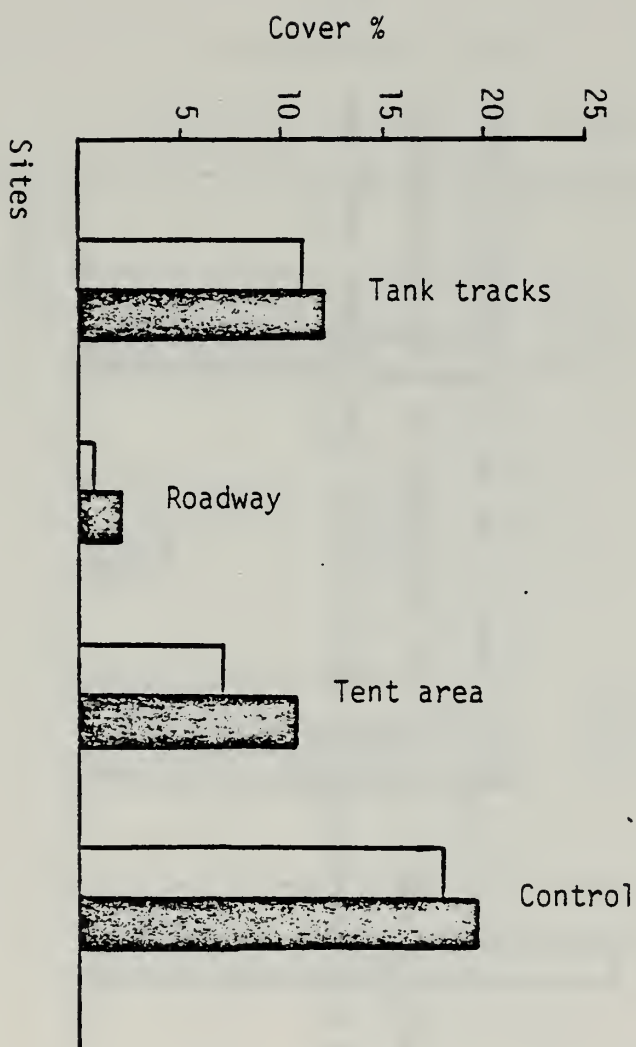


Table 1. Summary table of use.intensity types for study areas 1-7. See figure 18.

Areas

<u>Use type</u>	<u>Response type</u>	<u>Topography</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>
A. Concentrated	<u>Negative</u> . Forms	Steep hills,	✓	✓	✓	✓	✓		
recent and current	denuded strips	valleys,					Afton	non	
activities, no time	(trails and roads)	level trails.					Cyn	race	
for vegetation	and large expanses						only	only	
recovery	of ground (pit areas)								
B. Past to recent,	To annuals, <u>positive</u>	Broadflat, sandy				✓	✓	✓	
concentrated to	under certain	to rocky expanses,					Kelso	races	
dissipated use.	circumstances (edge	dunes, washes					Dunes		
Short periods of	effect or breaking	abundant							
time for recovery	surface of soil for								
of vegetation	seedlings) to long-								
	lived perennials-								
	<u>negative</u>								
C. Past concentrated	<u>Negative</u> -denuded roads	Flat, open country.							✓
use in localized	roads, tracks and	Gravelly sand to desert							
areas. Long period	tent areas. Recovery	pavement. Not inviting							
of time for recovery	extremely slow.	to ORV and RV							

Figure 1: Percent change of perennial vegetation in reaction to disturbance intensity in General Patton's WWII camps, Essex (A) and Needles (B), California as determined from ground measurements of density ($\square$) and cover ($\blacksquare$). Disturbance intensity is represented, in order of increasing use intensity, by tent area (1) tank tracks (2) and roadway (3).

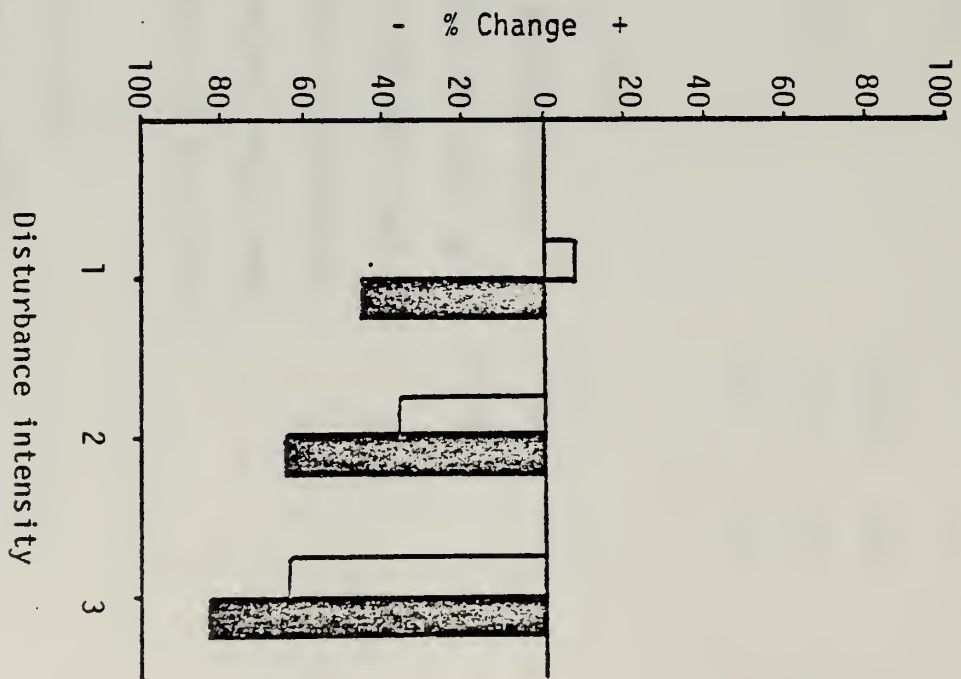
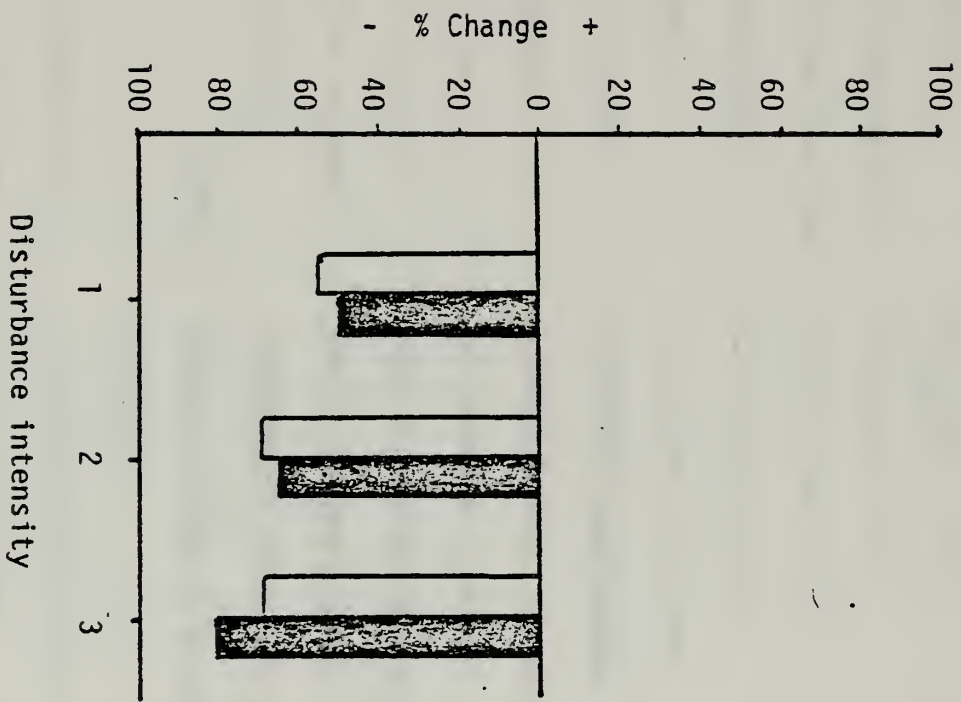


Figure 2. Percent change of perennial vegetation in relation to disturbance intensity in General Patton's WWII camp, Essex, California as determined from aerial photo analysis of density ($\square$) and cover ($\blacksquare$) for the years 1953 and 1974. Disturbance intensity is represented, in order of increasing use intensity, by tent area (1), tank tracks (2) and roadway (3).

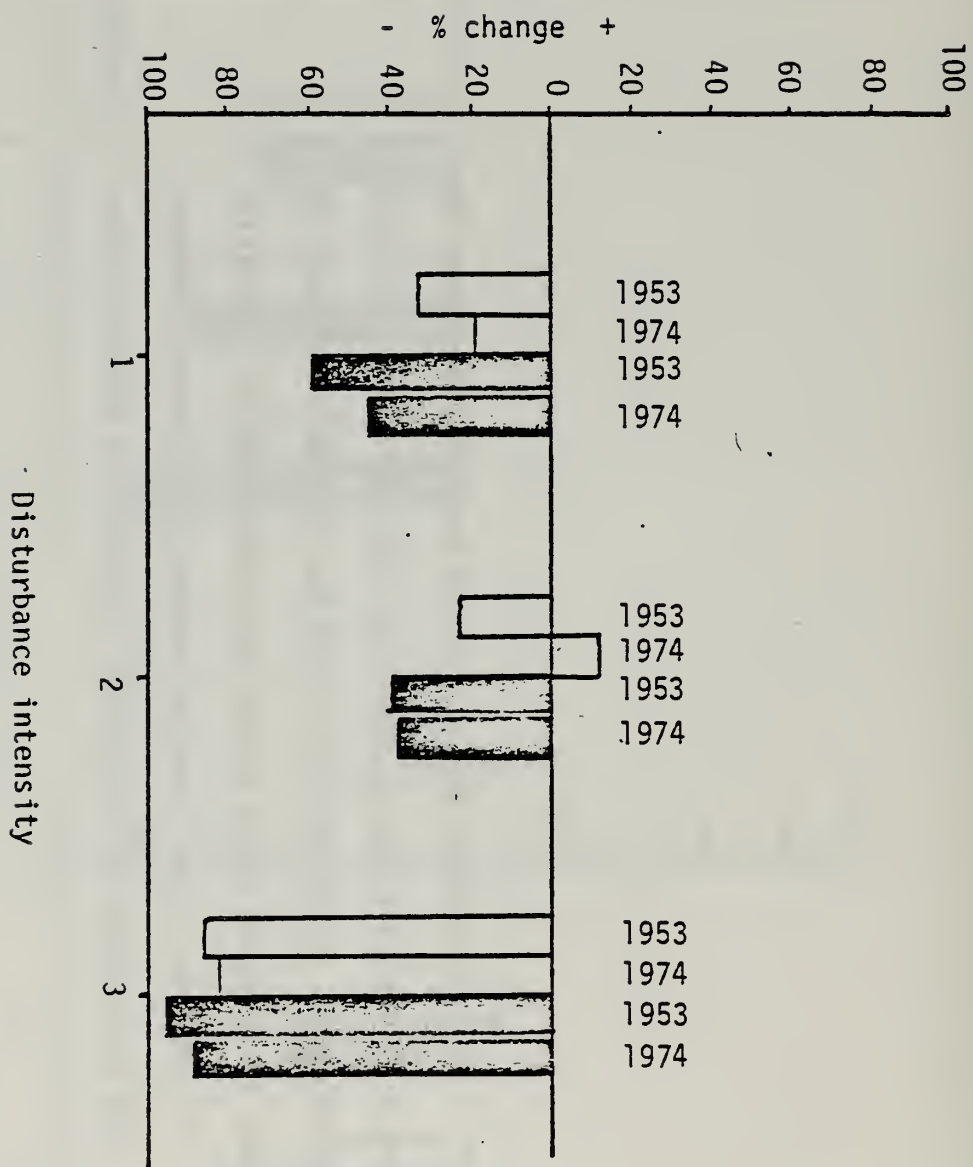


Figure 3. Percent change of perennial vegetation in relation to disturbance intensity in General Patton's WWII camp, Needles, California as determined from aerial photo analysis of density (□) and cover (■) for the years 1953 and 1974. Disturbance intensity is represented, in order of increasing use intensity, by tent area (1), tank tracks (2) and roadway (3).

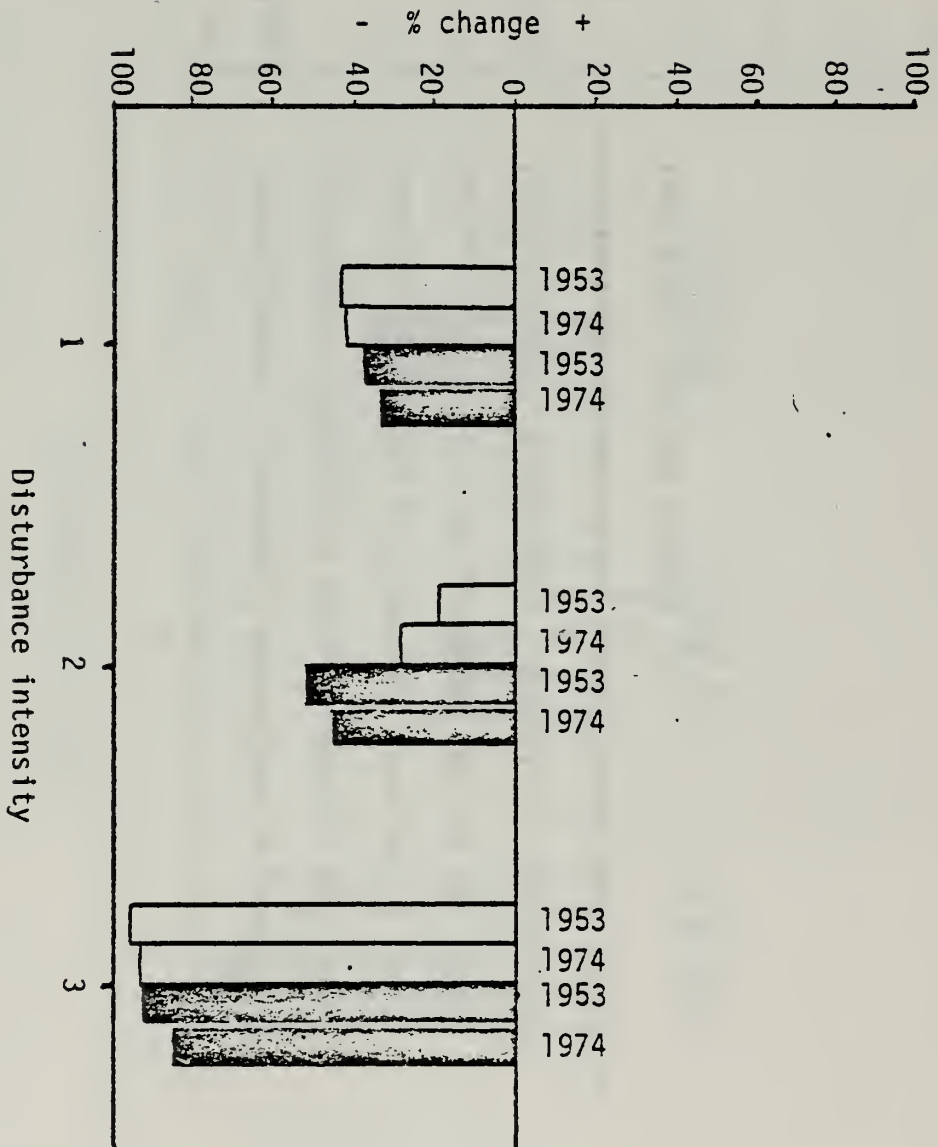


Figure 4: Successional recovery of perennial vegetation between the years 1953 and 1974 in relation to disturbance intensity in General pattons WWII camps at Essex (A) and Needles (B), California as determined from aerial photo analysis of denisty ($\square$) and cover ($\blacksquare$). Disturbance intensity is represented, in order of increasing use intensity, control (1), tent area (2), tank tracks (3) and roadway (4).

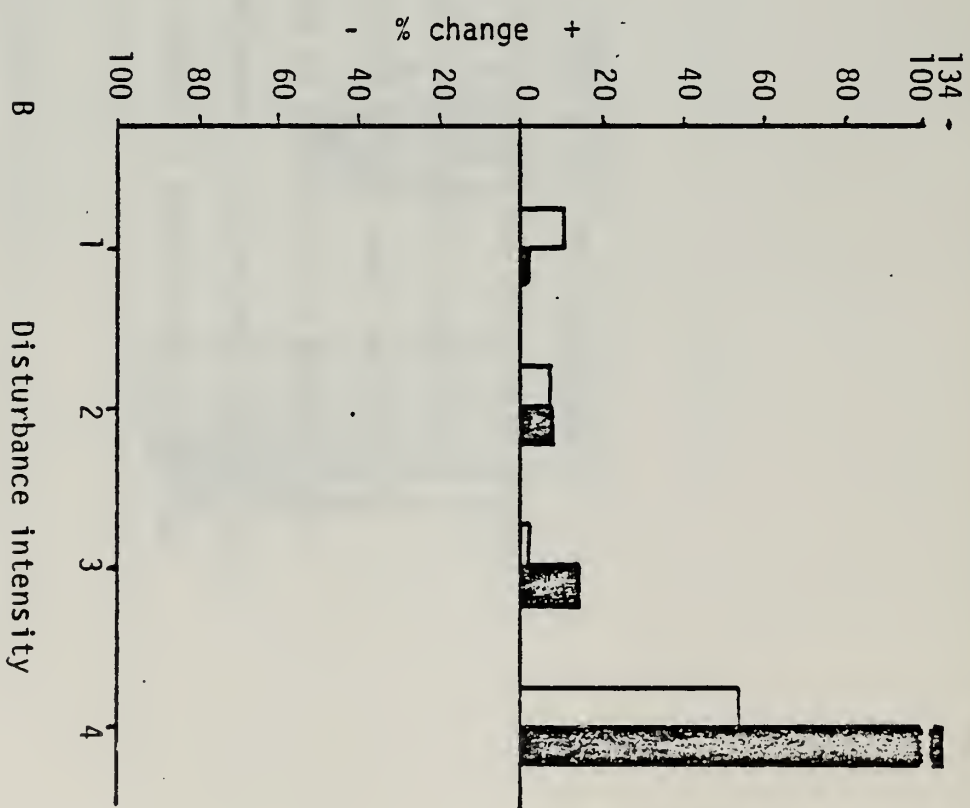
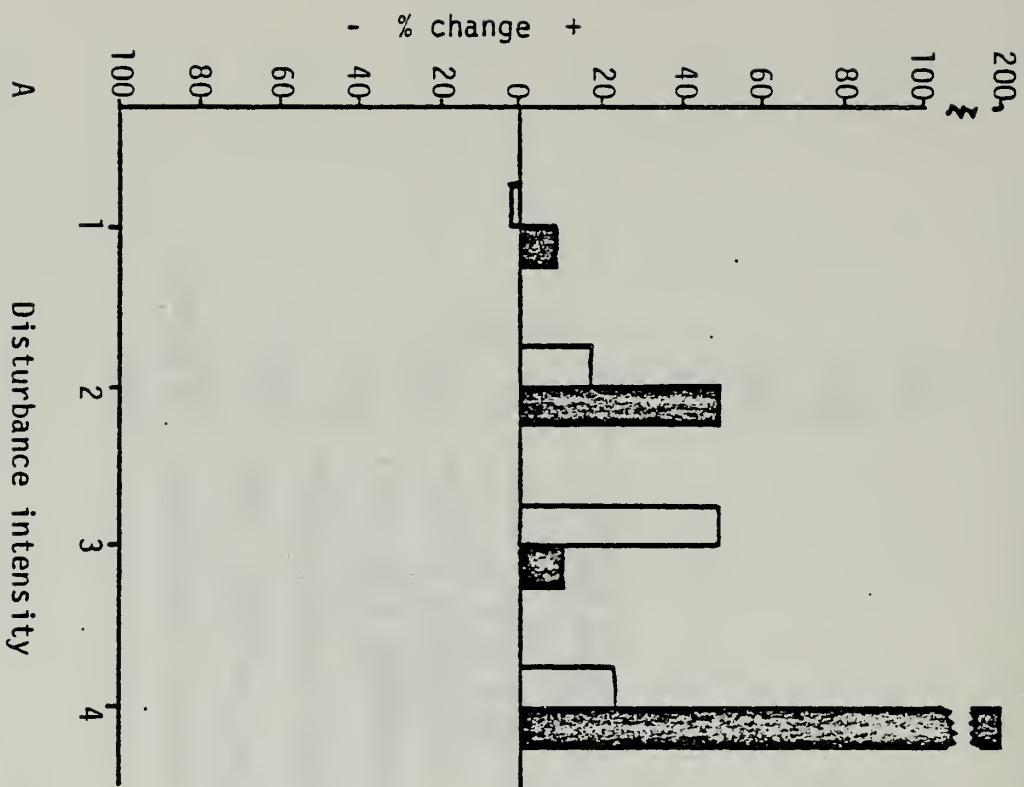


Figure 5: Percent change of annual vegetation in relation to disturbance intensity in the starting and beginning raceway of the Barstow to Vegas motorcycle race of Nov. 30, 1974. Disturbance intensity, arranged in order of increasing use intensity, is represented by the number of vehicle tracks counted within the ground test sites measured Dec. 11 and 12, 1977: sites 1, 10 tracks; site 2, 38 tracks; site 3, 45 tracks. Percent change values determined from measurements of cover.

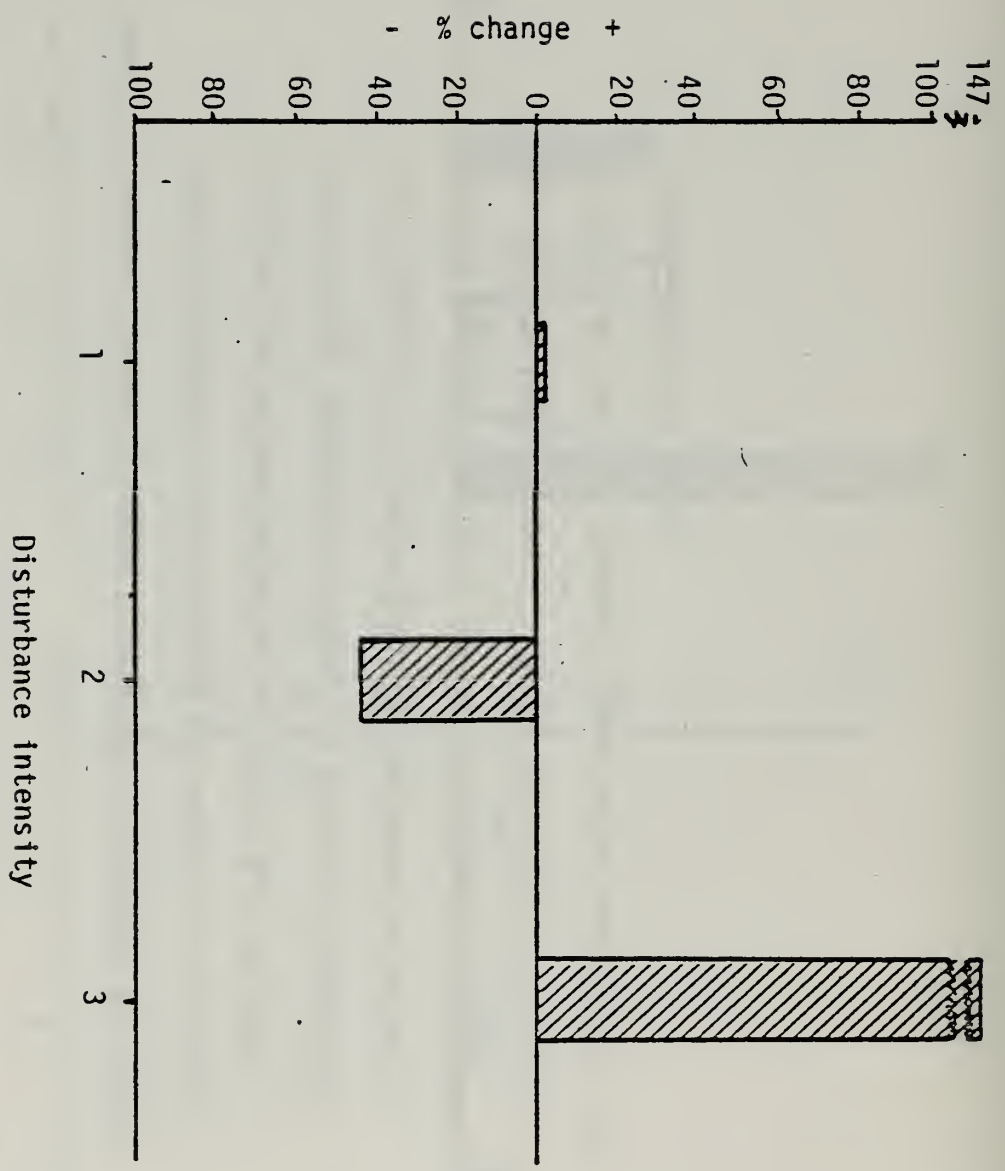


Figure 6: Percent change of perennial vegetation in relation to disturbance intensity at raceway sites along the early race course of the Barstow to Vegas motorcycle race of Nov. 30, 1974 as determined from ground (A) and aerial photo (B) measurements of mean density (see tables 6 and 8, Barstow to Vegas race). Disturbance intensity, in order of increased intensity (sites 1-2), is based in part on track frequency at the study sites.

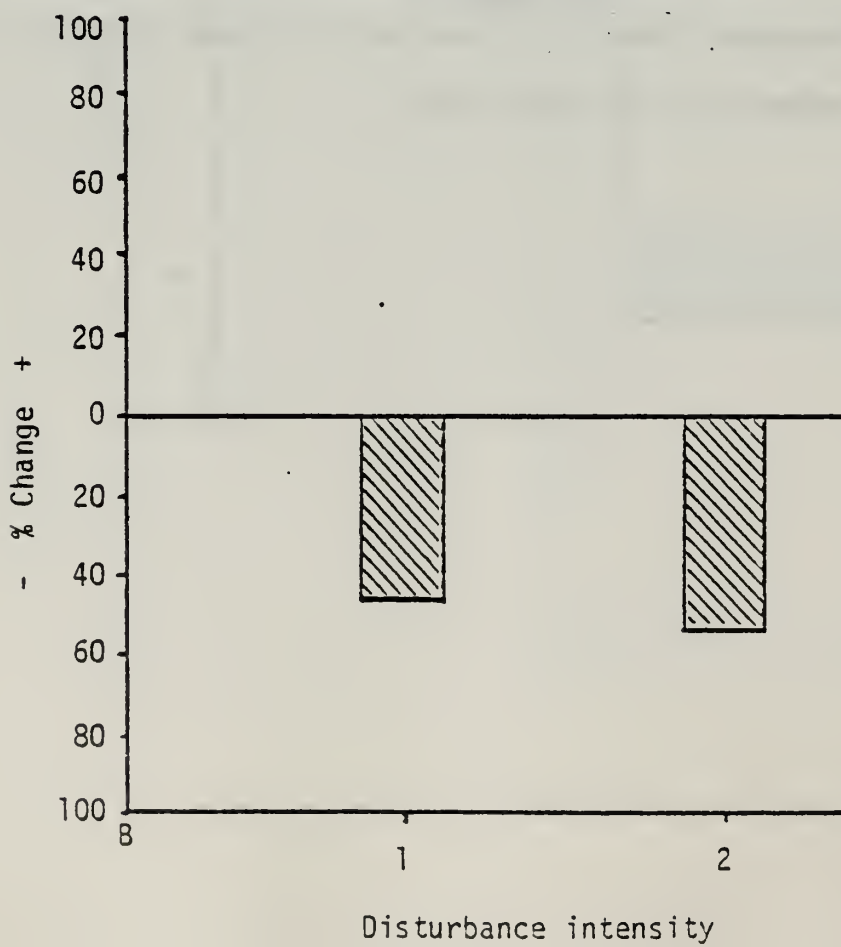
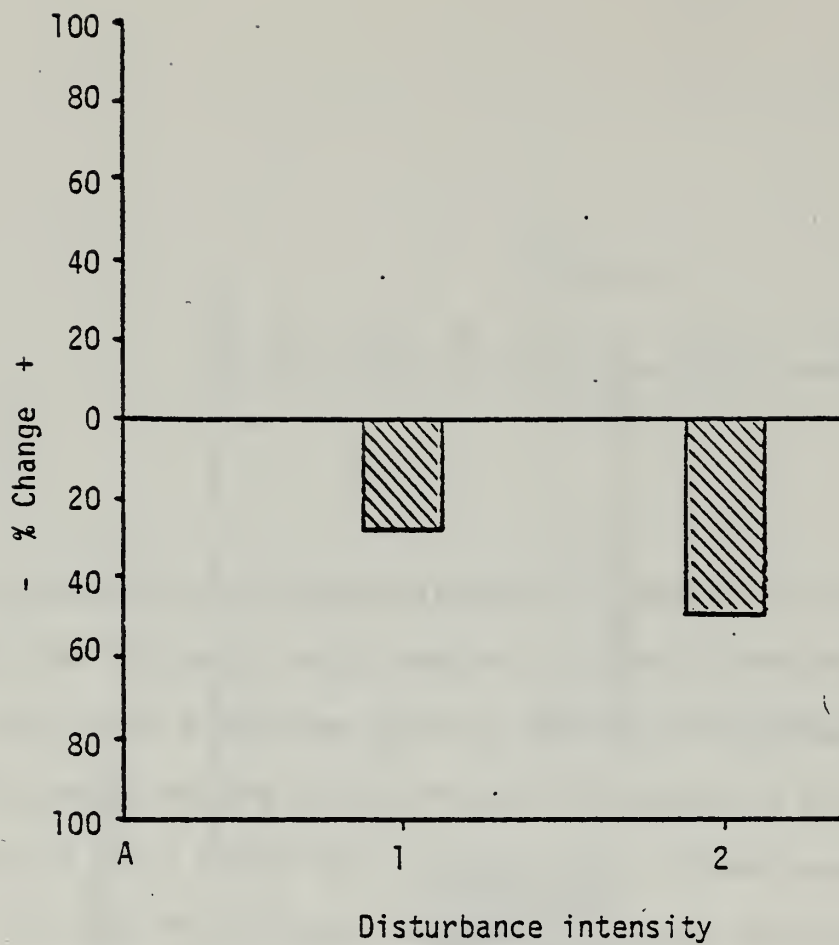


Figure 7: Percent change of perennial vegetation in relation to disturbance intensity recreational and off-road use sites in Dove Springs Canyon. Disturbance intensity values (1-3), determined from ground measurements of vegetation May 21, 1978, are based on partially denuded (1) to completely denuded (2,3) hillsides in the canyon. Percent change values calculated from measurements of cover.

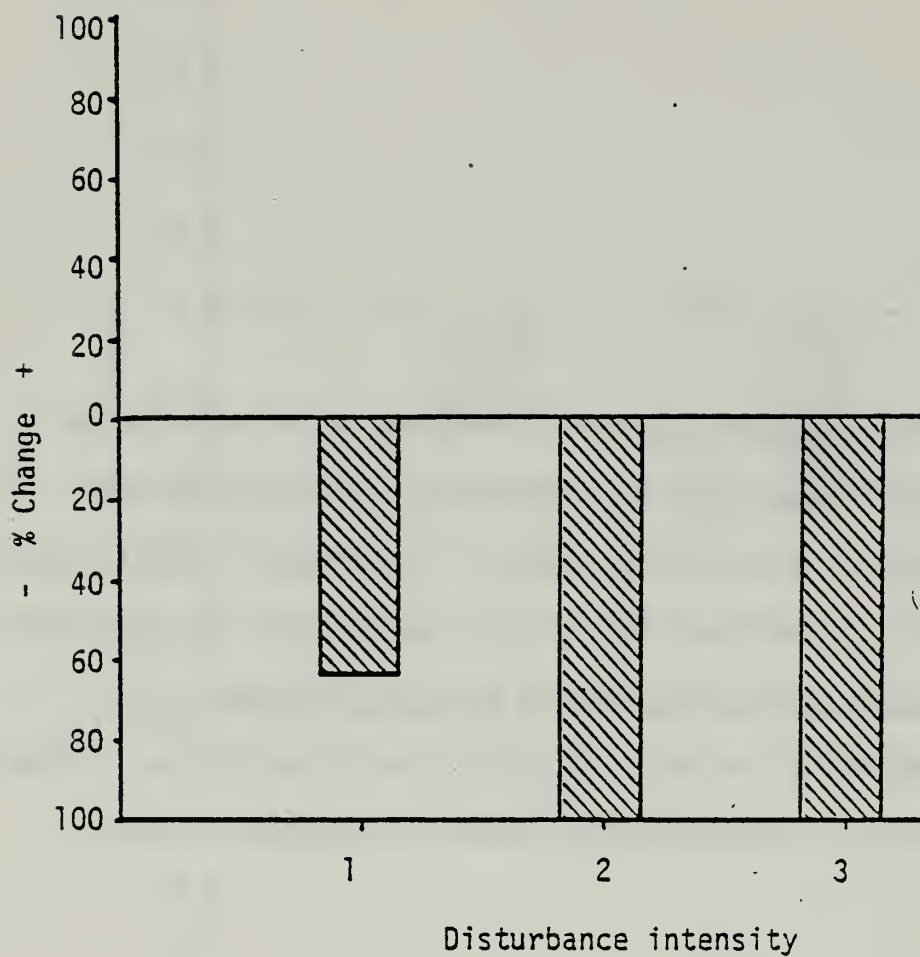


Figure 8. Percent change of perennial vegetation in relation to disturbance intensity at recreational and off-road vehicle use sites in Dove Springs Canyon. Disturbance intensity values (1-4), determined from comparative analysis of density from 1953 and 1973 series aerial photographs, represent pit area (□) and hillside trail (■) sites which occur progressively into the canyon.

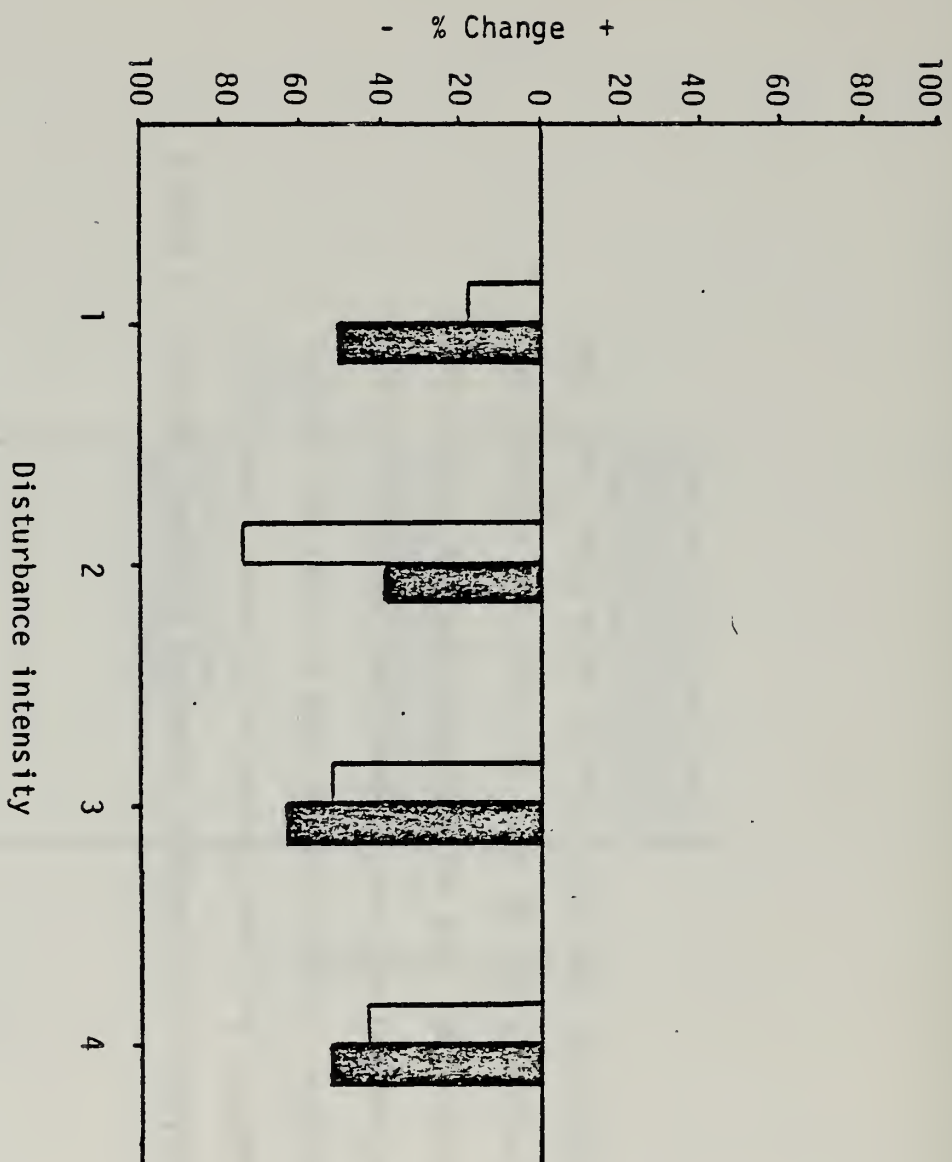


Figure 9: Percent change of perennial vegetation in relation to disturbance intensity at recreational and off-road vehicle use sites in Jawbone Canyon. Disturbance intensity values (1-4) are based on increased vegetation denutition measured for density (□) and cover (■) on the ground May 21, 1978 on a hillside (1-3) with sparse, dense and very dense motorcycle trails respectively and in a pit area (4).

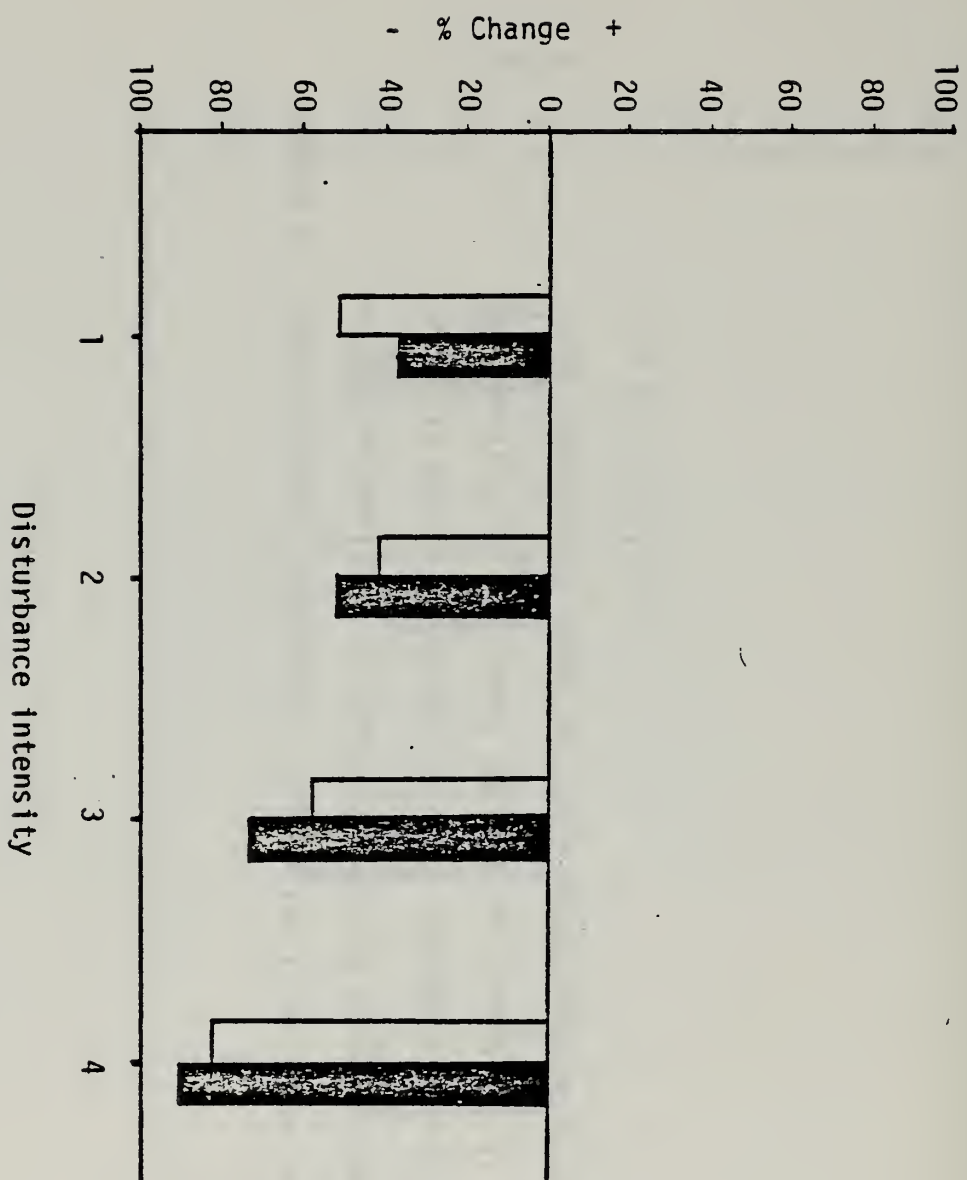


Figure 10: Percent change of perennial vegetation in relation to disturbance intensity at a recreational and off-road vehicle use site in Johnson Valley, Disturbance intensity values (1-8) are based on comparative measurements of density from 1952 and 1977 series aerial photographs using radiating transects placed at random degrees from the center of a large pit area to measure assumed decrease use intensity from the center of a pit area outward.

*Disturbance intensity values modified, see explanation above.

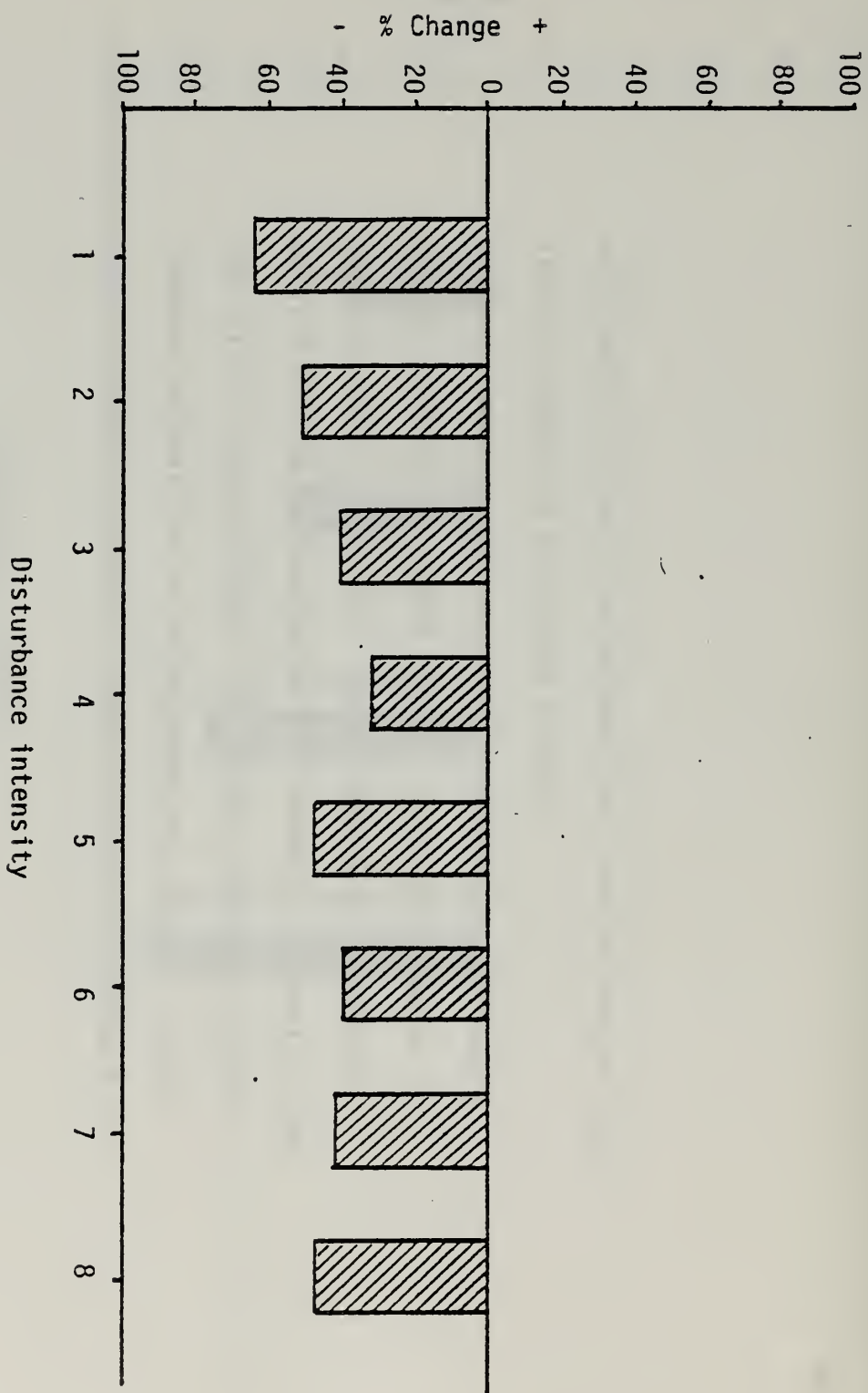


Figure 11. Percent change of perennial vegetation in relation to time use intensity values at a raceway site of the El Cajon Motorcycle Race held Dec. 3, 1972 in the Yuha Desert near Plaster City, California determined from analysis of density from aerial photographs. Disturbance intensity value 1 represents change of vegetation at the site between the years 1953 and 1972 with no race. Value 2 represents change during the race (between the dates of Nov. 26, 1972 and Dec. 12, 1972) at the same site.

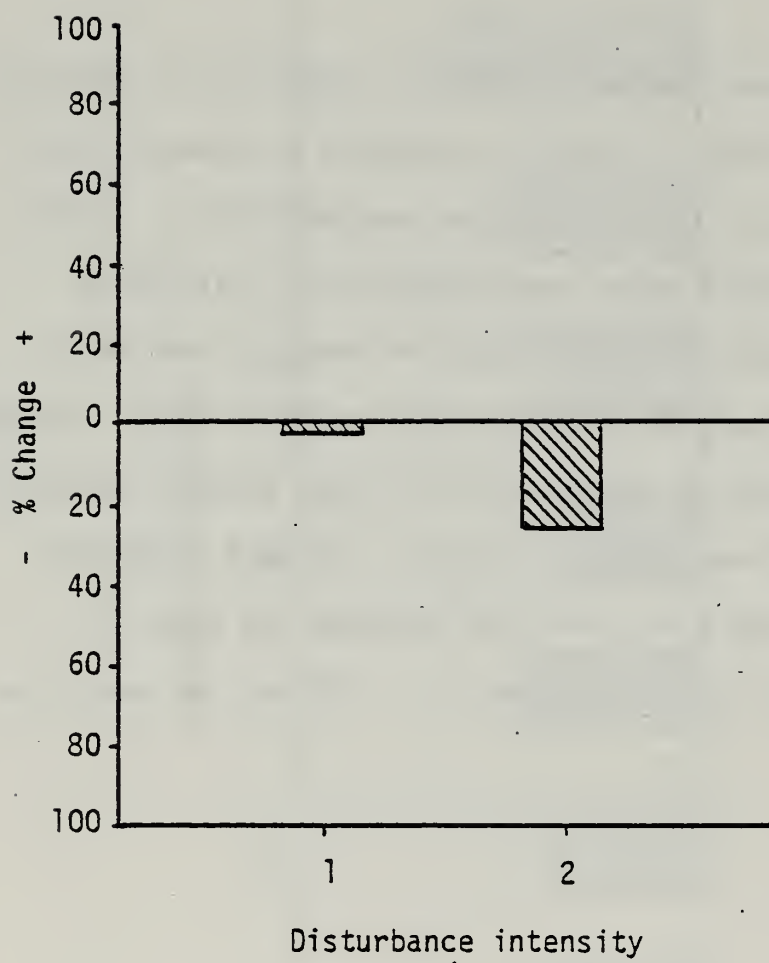


Figure 12. Percent change of perennial vegetation in relation to disturbance intensity at recreation pit areas near Plaster City, California as determined from analysis of density from 1953 and 1972 series aerial photographs. Disturbance intensity values (1-9) represent current observed use intensity at the pit areas in order of increasing intensity.

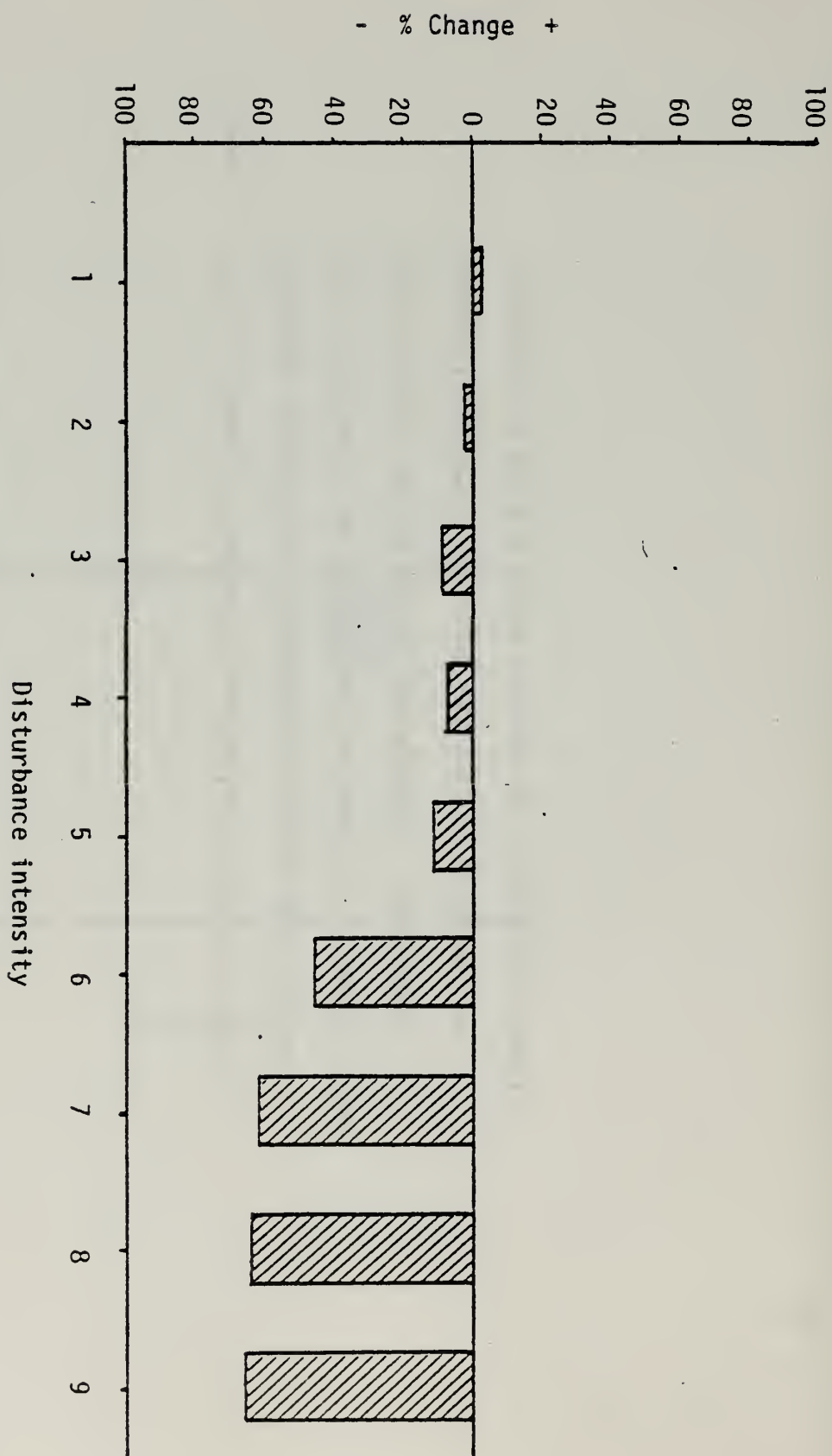


Figure 13. Percent change of perennial vegetation in relation to disturbance intensity at the El Cajon Motorcycle race of Dec. 3, 1972. Disturbance intensity values (1-3) are based on an observed increase disturbance intensity with decreased density (D) within four raceway study plots on aerial photographs taken before (Nov. 26, 1972) and after (Dec. 12, 1976) the El Cajon Race. Disturbance values: 1-D=1588; 2-D=1111; 3-D=960.

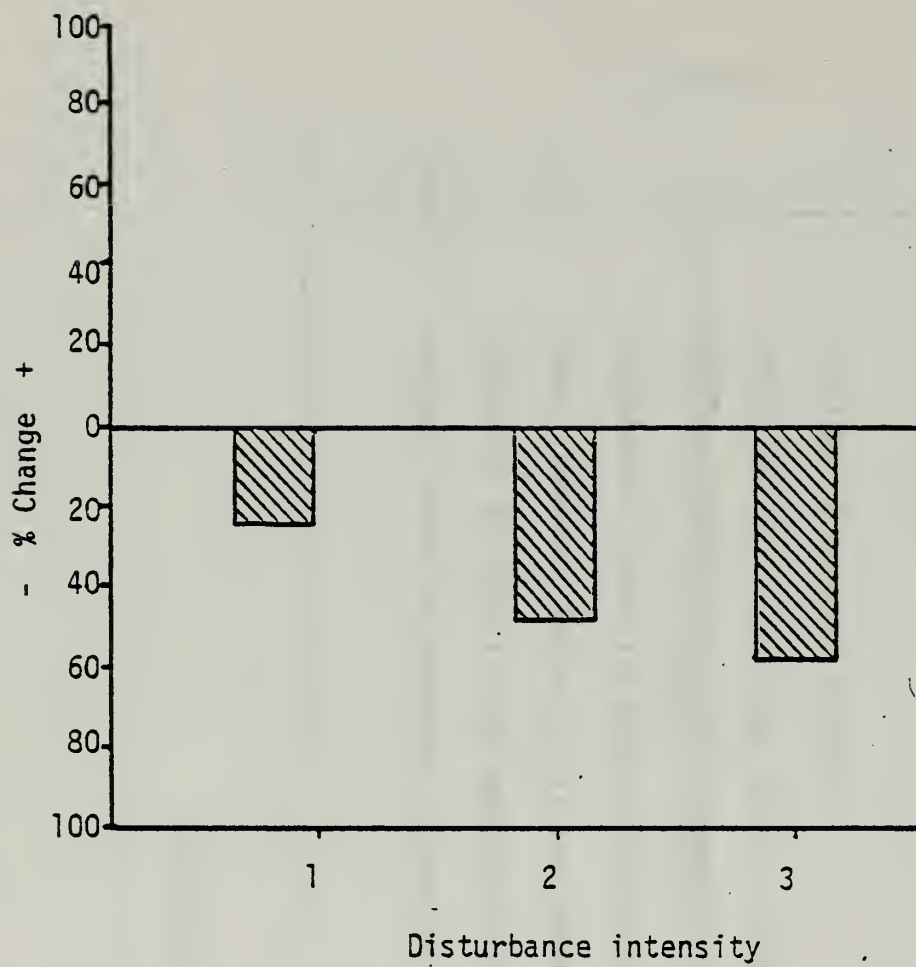


Figure 14. Percent change of perennial vegetation in relation to disturbance intensity at recreational and off-road vehicle use sites in Afton Canyon, 61 Km northeast of Barstow, California. Disturbance intensity values represent, in order of increased use intensity, vegetation denution. Hillside trails consisted of denuded strips (1) while pit areas (2) had large expanses of nearly complete denution. Ground measurements taken May 15, 1978. Percent change values determined from measurements of density (□) and cover (■).

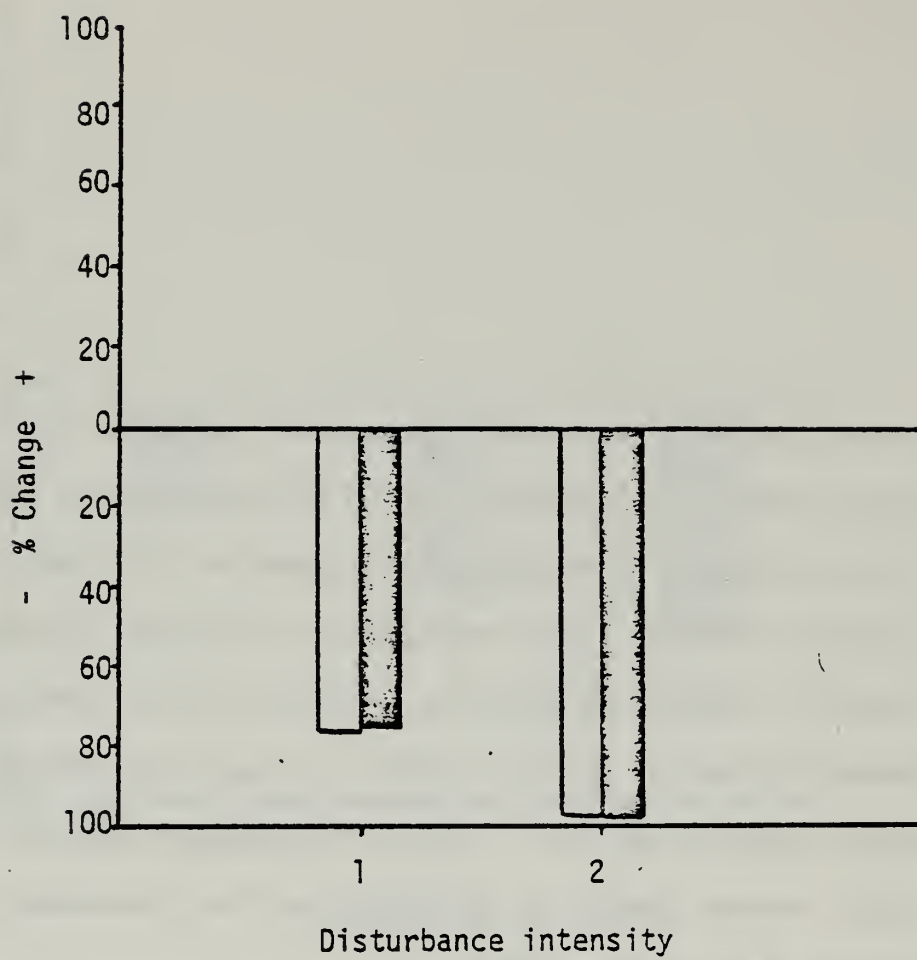


Figure 15. Percent change of perennial vegetation in relation to disturbance intensity in recreational and off-road vehicle use sites at Stoddard Valley as determined from ground measurements taken May 14 and 28, 1978. Disturbance intensity values (1-4) represent, in order of increasing use intensity, progressive denution of vegetation at study sites: 1-hillside trails; 2-raceway; 3-pit area in creosote bush scrub; 4-pit area in alkali sink. Percent change values based on density ($\square$) and cover ($\blacksquare$).

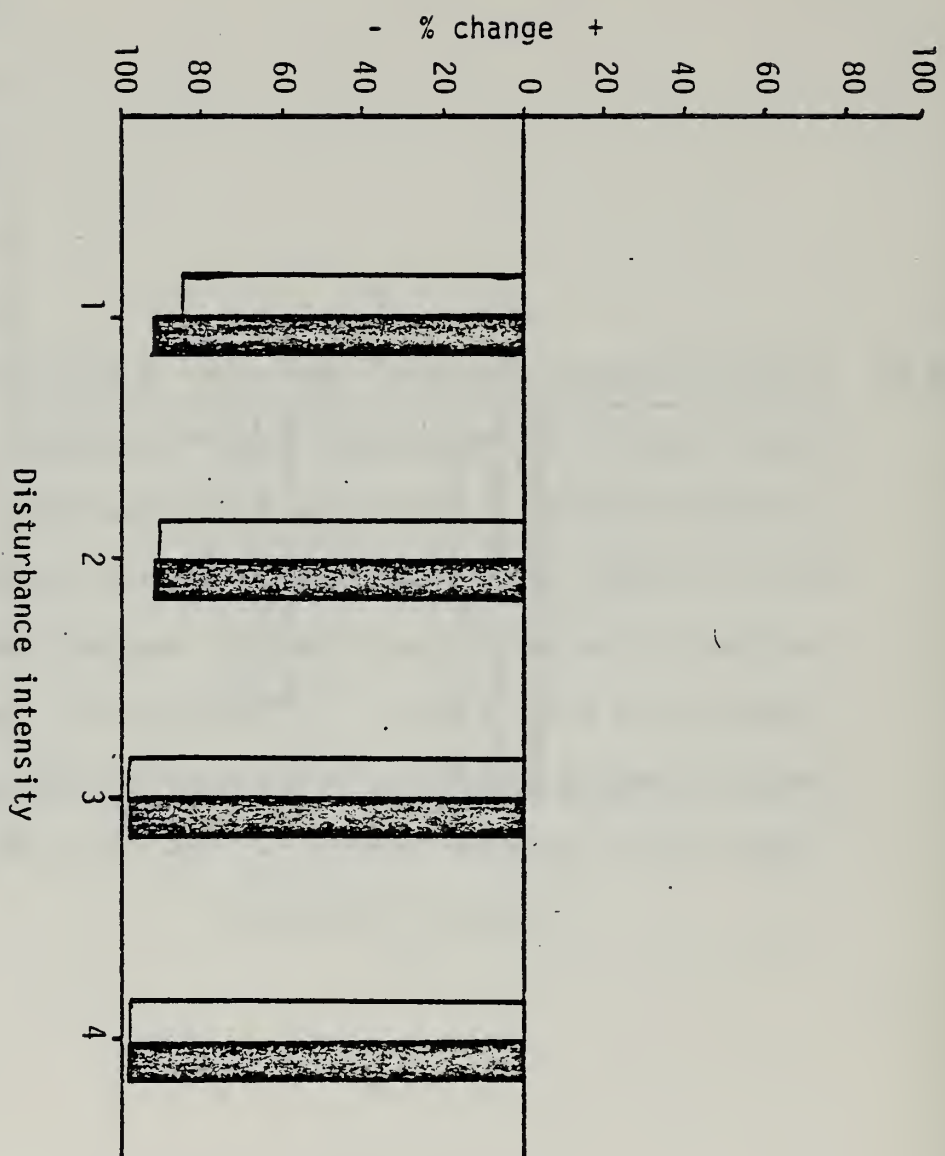


Figure 16. Percent change of perennial vegetation in relation to disturbance intensity at the Kelso sand dunes as determined from comparisons of aerial photographs taken before (Apr. 15, 1953) and after (June 9, 1974) use by recreational vehicles. Disturbance intensity values (1-3) represent progressive increase in use intensity from the vehicle hillruns of the fore dunes (□) to the pit area and trails of the desert floor (■) at three sites along the edge of the dunes. Percent change values determined from measurements of density.

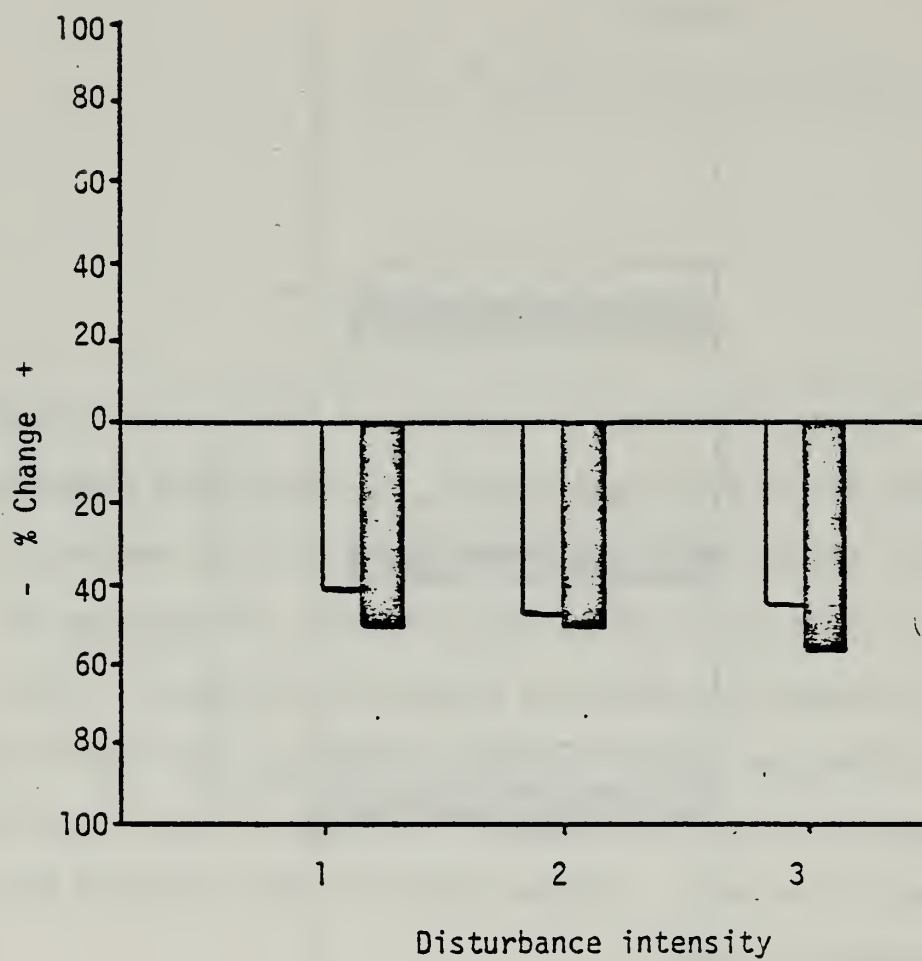


Figure 17. Percent change in perennial vegetation in relation to disturbance intensity in a large recreational vehicle pit area of Johnson Valley as determined from aerial photographs before (1953) and after (1972) establishment. Disturbance intensity values (1-6) represent presumed increasing disturbance from the periphery of the pit area inward. Percent change values calculated from density figures.

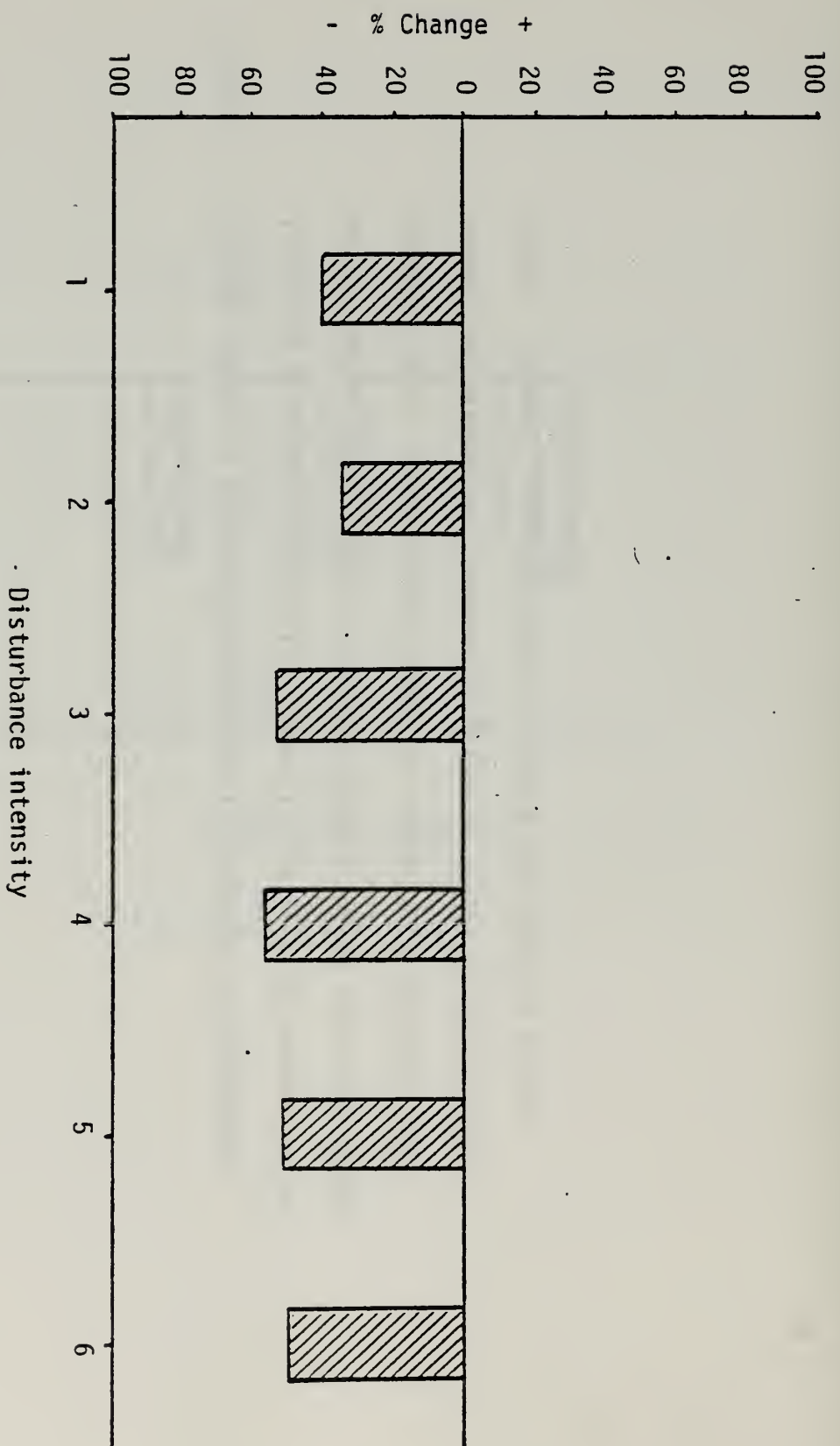
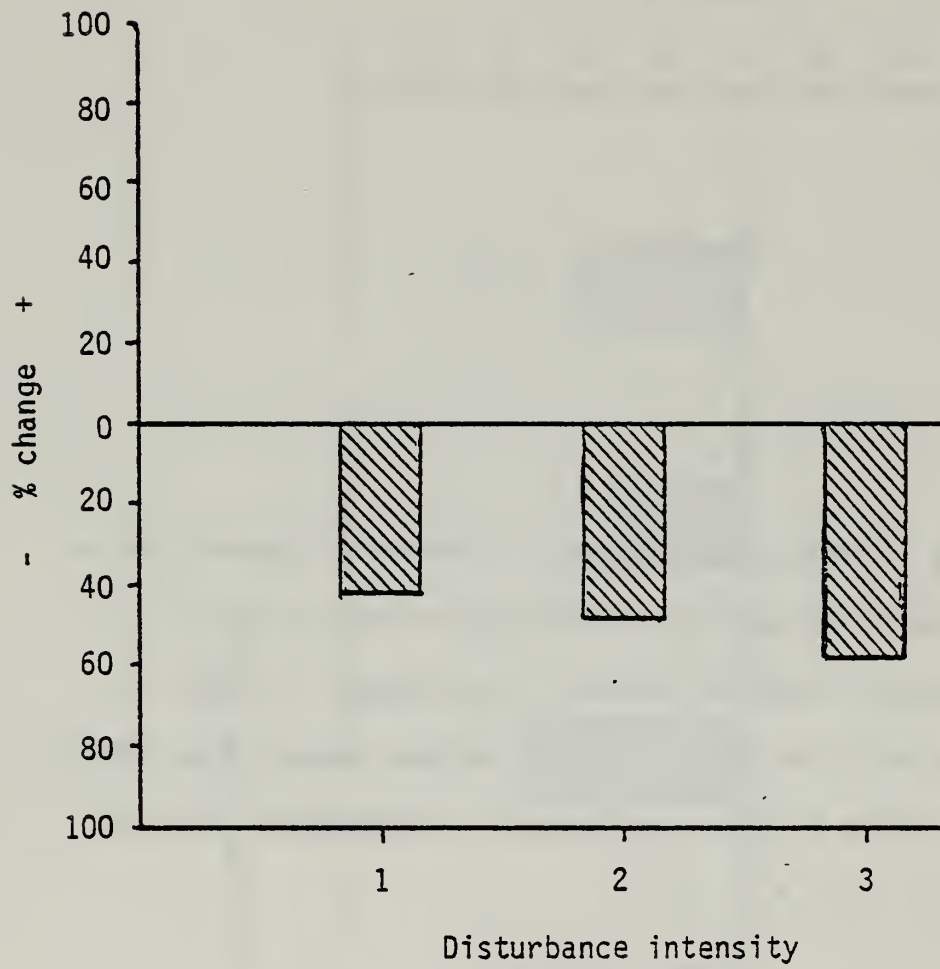


Figure 18. Summary of mean percent change of perennial vegetation in relation to disturbance intensity for study areas 1-7. Disturbance intensity values 1-3, arranged in order of increasing intensity, are based on area summary use intensity types (Table 1, ABC, conclusions). Disturbance intensity value 1 = B, 2 = C, 3 = A.



BIBLIOGRAPHY

- Arndt, W. 1966. The effect of traffic compaction on a number of soil properties. J. Agricultural Engineering Res. 11:182-187.
- Berry, K.H. ed. 1973. Preliminary studies on the effects of off-road vehicles on the northwestern Mojave Desert. Privately published, Ridgecrest, Ca. p. 100.
- Berry K. ed. 1977. Proceedings of the symposium on the physical, biological, and recreational impacts of off-road vehicles on the California Desert. So. Calif. Acad. Scis. Spec. Pub. (Unpublished).
- Broadbent, S. 1974. Scavengenes on wheel. Sierra Club Bulletin.
- Brower, J.E. and J.H. Zar. 1977. Field and laboratory methods for general ecology. Wm. C. Brown Co., Dubuque, Ioqa. 194.
- Bureau of Land Management. 1970. Summary of the off-road vehicle advisory council report. Pamphlet by the US. Dept. of the Interior. Bureau of Land Management.
- Bureau of Land Management. 1970. The California Desert; a critical environmental challenge. US Department of the Interior. Bureau of Land Management.

Bureau of Land Management. 1973. Environmental analysis record for the interim critical management program for off-road vehicle use of the California desert. US Department of the Interior. Bureau of Land Management.

Bureau of Land Management. 1973. Evaluations and recommendations El Cajon Valley motorcycle club's unauthorized race---Feb., 1973. US Department of the Interior. Bureau of Land Management.

Bureau of Land Management. 1974. Environmental assessment, Barstow-Vegas motorcycle race----August, 1974. US Department of the Interior, Bureau of Land Management.

Bureau of Land Management. 1975. Evaluation report, 1974. Barstow-Las Vegas motorcycle race---March, 1975. US Department of the Interior. Bureau of Land Management.

Bureau of Land Management. 1974. Final Environmental impact statement, proposed Barstow-Las Vegas motorcycle race. US Department of the Interior. Bureau of Land Management.

Carter, L.J. Off-Road vehicles: a compromise plan for the California Desert. Science 183(4123):396-9.

Davidson, E., and M. Fox. 1974. Effects of off-road motorcycle activity on Mojave Desert vegetation and soil. Madrono 22:381-390.

- Duck, T.A. 1976. The effects of off-road vehicles on desert flora. in Abstracts, So. Cal. Acad. Scis., Ann Mtg., Santa Barbara, Ca., 44.
- Duck, T.A. 1977. The effects of off-road vehicles on vegetation in Dove Springs Canyon. in Berry, K. (ed.). Proc. of the symposium on the physical, biological, and recreational impacts of off-road vehicles on the California desert. So. Calif. Acad. Scis., Spec. Pub. (unpub.)
- Hadley, R.F. and C.T. Snyder. 1975. Environmental impacts of off-road vehicles in arid areas. Geol. Soc. America Abs. Prog. 7:1095.
- Harrison, R. 1976. Environmental effects of off-road vehicles. Engineering tech. information system. US Department of Agriculture. 4-8.
- Hicks, D., A. Sanders, and A. Coopeerrider. 1976. Impacts of Barstow-Las Vegas motorcycle race on wildlife habitat. Bureau of Land Management Unpubl. Rept. 46.
- Johnson, H.B. 1976. Vegetation and plant communities of Southern California Deserts-a functional view. in J. Latting (ed.). Symposium proceedings plant communities of Southern California. California Native Plant Society Spec. Publ. no. 2 Riverside, California. 125-162.
- Johnson, S. 1974. Rv/II: The new generation of recreational vehicles. Sierra club bulletin.

Keefe, J., and K. Berry. 1973. Effects of off-road vehicles on desert Shrubs at Dove Springs Canyon, in K. Berry, (ed.). Preliminary studies on the effects of off-road vehicles on the northwestern Mojave Desert. A collection of papers. Privately published, Ridgecrest, California. pp. 19-44.

Luckenbach, R.A. 1975. What the ORVs are doing to the desert. Fremontia 2:3-11.

Larson, F.R. 1971. A comparison of aerial photo and ground measurements of Ponderosa pine stands. USDA Forest Service Research Note RM 192.

Los Angeles Times. Dec. 17, 1974. Battle for the Great Mojave.

Murchie, D.R. 1973. What trackless desert. Sierra Club Bulletin.

Office of Library Services. 1973. Environmental effects of off-road vehicles. A review of the literature. US Department of the Interior. Office of Library Services, Bibliography series #29.

ORV Monitor. 1974. ORVs and the California Desert. A Case Study.

Press-Enterprise. 1978. Wilderness: The Coming Struggle.

Snyder, C.T., D.G. Frickel, R.E. Hadley, and R.F. Miller. 1976. Effects of off-road vehicle use on the hydrology and landscape of arid environments in Central and Southern California. US Geological Survey Water-Resources Investigations 76-99:45.

Stebbins, R.C. 1974. Off-road vehicles and the fragile desert. Amer. Biol. Teacher. 36:203-208, 294-304.

Thorne, R. F. 1976. The Vascular plant communities of California. pp. 1-31. In J. Latting (ed.), Symposium proceedings plant communities of Southern California. California Native Plant Society Spec. Publ. no. 2, Riverside, Calif.

Turner, R. B., A. T. Vollmer, B. G. Maza, and P. A. Medica. 1976. Effects of off-road vehicles on a creosote-bush community in Southern Nevada. In Abstracts, So. Cal. Acad. Scis., Ann. Mtg., Santa Barbara, Ca., p. 45.

Vollmer, A. T., B. G. Maza, P. A. Medica, F. B. Turner, and S. A. Bamberg. 1976. The impact of off-road vehicles on a desert ecosystem. Environmental Management. 1(2):115-129.

Webb, R. H. 1977. The effects of off-road vehicles on desert soil in Dove Springs Canyon. In Berry, K. (ed.), Proc. of the Symposium on the physical, biological, and recreational impacts of off-road vehicles on the California desert. So. Calif. Acad. Scis., Spec. Pub. (unpubl.)

Webb, R. H., and H. G. Wilshire. 1977. A Bibliography on the Effects of Off-road Vehicles on the Environment. 12p.

Wilshire, H. G. 1977. Study results of 9 sites used by off-road vehicles that illustrate land modifications. US Geological Survey Open-file Rept. 77-601:19.

Wilshire, HG., and JK. Nakata. 1976. Off-road vehicle effects on California's Mojave Desert. Calif. Geology. 29:123-132.

Wilshire, HG., and JK. Nakata. 1977. Erosion of off-road vehicle sites in southern California. in Berry, K. (ed.). Proc. of the symposium on the physical, biological, and recreational impacts of off-road vehicles on the California desert. So. Calif. Acad. Scis., Spec. Pub. (unpubl.)

Related Articles

Johnson, H. B., F. C. Vasek and T. Yonkers. 1975. Productivity, Diversity and Stability Relationships in Mojave Desert Roadside Vegetation. Department of Biology, University of California, Riverside, CA. Bulletin of the Torrey Botanical Club. 102(3):106-115.

Sharp, R. P. Kelso Dunes, Mohave Desert, CA. Geo. Soc. of Amer. Bull. V. 77, p. 1045-1074. 19 Figs. Pls. Oct. 1966.

Vasek, F. C., H. B. Johnson and G. D. Brum. 1975. Effects of power transmission lines on vegetation of the Mojave Desert. Madrono 23(3): 114-130.

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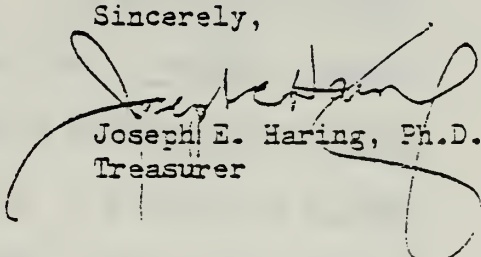
June 20, 1978

Dear Professor Lathrop:

Regretfully, we find that we shall be unable to complete publication of the symposium papers which you ordered some time ago (the proceedings of our 1976 symposium on "The Physical, Biological, and Social Impacts of Off-Road Vehicles on the California Desert"). Consequently, we are enclosing our refund of your payment.

Thank you for your patience; we are truly sorry not to be able to fill your order. Should the papers become available at some later date we will let you know, in case you might wish to re-order at that time.

Sincerely,



Joseph E. Haring, Ph.D.
Treasurer

JEH:B

Enc: chk #3086 - \$5.00

APPENDIX A

Plant Specimen List Plant Response Parameters to RV and ORV in the CDCA

Aizoaceae

Mollugo cerviana (L.) Ser.

Asteraceae

Acamptopappus sphaerocephalus (Harv. & Gray) Gray

Ambrosia dumosa (Gray) Payne

Baileya pauciradiata Harv. & Gray

Bebbia juncea (Benth) Greene

Brickellia incana Gray

Dyssodia cooperi Gray

Dyssodia ⁴therberi (Gray) Nels.

Encelia farinosa Gray ex Torr.

Encelia virginensis A. Nels.

Erigeron pumilus Nutt. ssp. concinoides Crong.

Eriophyllum wallacei Gray

Gutierrezia microcephala (DC.) Gray

Geraea canescens T. & G.

Haplopappus acradenius (Greene) Blake

Haplopappus cooperi (Gray) Hall

Hymenoclea salsola T. & G.

Lepidospartum squamatum (Gray) Gray

Machaeranthera tortifolia (Gray) Crong. & Keck.

Palafoxia linearis (cav.) Lag

Pectis papposa Harv. & Gray ex Gray

Stephanomeria pauciflora (Torr.) Nutt

Agavaceae

Yucca shidigera Roege ex Ortigies

Tetradymia ~~steno~~²lepis Greene ??

Bignoniaceae

Chilopsis linearis (Cav.) Sweet Desert mallow

Boraginaceae

Coldenia palmeri Gray

Coldenia plicata (Torr.) Cov.

Brassicaceae

¹
Lep~~y~~dium fremontii Wats

Cactaceae

Echinocactus polycephalus Engelm & Bigel

Opuntia basilaris Engelm & Bigel

Opuntia echinocarpa Engelm & Bigel

Opuntia ramossima Engelm

Capparaceae

Cleomella obtusifolia Torr. & Frem

Isomeris arborea Nutt. var. arborea (Cleome isomeris Greene)

Chenopodiaceae

Atriplex canescens (Pursh) Nutt

Atriplex ^y~~h~~umenelytra (Torr.) Wats

Atriplex ploycarpa (Torr.) Wats

Ceratoides lanatum (Pursh) T. Howell

Grayia ^a~~z~~ spinosa (Hook) Mog.

Ephedraceae

Ephedra nevadensis Wats.

Euphorbiaceae

^a
Croton californicus Muell-Arg

Fabaceae

Acaccia greggii Gray

Cassia armata Wats. ✓

Cercidium floridum (Benth) Wats. Benth.

Dalea californica Wats.

Dalea emoryi Gray

Prosopis glandulosa Torr. var. torreyana (L. Benson) M.C. Jtn.

Lamiaceae

Salvia columbariae Benth.

Salvia dorii (Kell.) Abrams

Salazaria mexicana Torr.

Lennoaceae

Pholisma arenarium Nutt. ex Hook.

Loasaceae

Petalonyx thurberi G.

Malvaceae

Eremalche rotundifolia (Gray) Greene

Nyctaginaceae

Mirabilis froebelii (behr.) Greene

Papaveraceae

Argemone corymbosa Greene.

Plantaginaceae

Plantago aristata Michx.

Poaceae

~~Ab~~ Stida fendleriana Steude

Bouteloua barbata Lag

Bouteloua eriopoda (Torr.) Torr.

Erioneuron pilosum (Buckl) Nash

Hilaria jamesii (Thurb.) Benth. ex Scribn.

Hilaria rigida (Thurb.) Benth. ex Scribn.

Muhlenbergia ~~potteri~~ Scribn.

Oryzopsis ~~hum~~enoides (R.&.S.) Ricker

Tridens muticus (Torr.) Nash

Polygonaceae

Eriogonum fasciculatum Benth

Eriogonum ~~heer~~mannii Dur. & Hilg.

Eriogonum inflatum Torr. & Frem.

Rosaceae

Coleogyne ramosissima Torr.

Fallugia paradaxa (D. Dom) Endl

Prunus fasciculata (Torr.) Gray

Solanaceae

Datura meteloides A.DC.

Lycium cooperi Gray

Zygophyllaceae

Larrea tridentata (sesse & Moc ex DC.) Cov.

APPENDIX B

1. Calculations

$$\bar{d} = \sum di / \sum n$$

$$\bar{A} = d^2$$

$$TD = u / \bar{A}$$

$$RD_i = n_i / \sum n$$

$$D_i = (n_i / \sum n) (u / \bar{A})$$

$$Fi = Ji / K$$

$$Rf_i = F_i / \sum f$$

$$Ci = (a_i) (D_i) / n_i$$

$$RC = C_i / \sum C$$

$$IV = RD_i + Rf_i + RC_i$$

$$t = \frac{t_{\Delta} \sqrt{h}}{S_{\Delta}}$$

$$s_{\bar{x}} = \frac{s}{\sqrt{n}}$$

$$ID_i = ni / L$$

$$ICi = li / L$$

$$Rci = li / \sum l$$

APPENDIX B

2. Symbols

TD	= total density
Di	= density of individual species
u	= unit area
$\bar{A}$	= mean area per plant ²
RD	= relative density
ni	= is the number of individual of species
i	= species
Σn	= total no. of individuals of all species measured
f_i	= frequency of species i
ji	= no. of sampling pts. at which species i was counted
k	= total no. pts/plots samples
RF	= rel. freq.
Ci	= coverage for species i
ai	= sum of foilage coverages
IV	= Imp. value = $RD_i + RF_i + RC_i$
di	= point to plant distance for individual i
$\bar{d}$	= mean pt. to plant distance
Σdi	= sum of individual pt. to plant distances
$\bar{d}^2$	= mean pt. to plant distance square
d	= sum of d_i
t	= t statistic evaluation (paired observations)
D.F.	= degrees of freedom
$\bar{x}$	= mean
SD	= standard deviation

APPENDIX B II

Symbols (con't)

$s\bar{x}$ = standard error of the mean

l_i = sum of intercept lengths for species i

L = total length of all transect sampled

Σl = sum of intercept lengths for all species

Ic_i = linear coverage index

ID_i = linear density index

RC = relative cover

RC_i = relative cover for species i

Σ = sum

APPENDIX C

Plant community classifications for the CDCA

Thorne (1976)

Creosote bush scrub

Alkaline scrub (alkali sink)

Desert dune Sandplant

Blackbush scrub

Johnson (1976)

Cheesebush scrub

APPENDIX D

Study Areas

Area 1

✓Jawbone Canyon:

19 miles NNE Mojave, Kern County, California

5 miles W Hwy. 14

T 30S, R37E, Secs. 19,20

T 30S, R36E, Secs. 20,21,22,23,24,27,28

T 29S, R36E, Sec. 14.

✓Dove Springs:

24 miles NNE Mojave

11 miles W of Hwy. 14

T 29S, R37E, Secs, 5,6,7,8,9,16

T 29S, R36E, Secs. 1,2

T 28S, R36E, Secs. 31,32,33,34,35

✓Area 2

Stoddard Valley:

5 miles SW Barstow, San Bernardino County, California

1-3 miles SSE of I-15

T 9N, R2W, Secs. 26,27,35,36

✓Area 3

Johnson Valley

14 miles E Lucerne Valley on Hwy 247 N

6 miles beyond Soggy Dry Lake, San Bernardino County, California

T 5N, R3E, Secs. 28,27,21,22

Area 4

✓ A. Afton Canyon

38 miles NE Barstow, San Bernardino County, California

4.5 miles ESE I-15

T 10N, R5E, Secs. 17,18

✓ B. Kelso Dunes

12 miles SSW Kelso, San Bernardino County, California

T 10N, R12E, Secs, 3,9,10

Area 5

Plaster City:

✓ a. Pit area no. 1

3.5 miles E Plaster City, Imperial County, California .5

2 miles S hwy. 80

T 15S, R11E, Secs. 14,15

✓ b. Pit area no. 2

1.5 miles E Plaster City, 1 miles N Hwy. 80 5

T 15S, R11E, Secs, 14,15

✓ c. Pit area No. 3

2.5 miles W Plaster City, Continuous to the N and S sides Hwy. 80

T 15S, R10E, Secs. 1,7,12

d. El Cajon Motorcycle Race

✓ Yuha Desert

Site 1 - T 15N, R11E, Sec. 18

Site 2 - T 15S, R10E, SW $\frac{1}{4}$ Sec. 24

Site 3 - T 16S, R11E, Sec. 15

Site 4 - T 15S, R11E, Sec. 21

Area 6

Barstow to Vegas Race:

Barstow, California to Las Vegas, Nevada

- ✓ a. Site 1 - T 10N, R4E, Sec. 6 San Bernardino County, California
- ✓ b. Site 2,3 - T 11N, R4E, Sec. 10 San Bernardino County, California
- ✓ c. Site 4 - T 11N, R4E, Sec. 17 San Bernardino County, California
- d. Site 5 - T 12N, R5E, Sec. 28 San Bernardino County, California

Area 7

Patton WWII Camps:

A. Approximately 8 Km NNW of Essex, San Bernardino County, California

T 8N, R17E, Sec. 21 Fenner Quad Tank tracks

T 8N, R16E, Sec. 11 Colton Well Quad Roadway

T 8N, R16E, Sec. 11 Colton Well Quad Tent area

T 8N, R16E, Sec. 15 Colton Well Quad Control

B. Approximately 32 Km NW of Needles, San Bernardino County, California

T 11N, R20E, Sec. 28 Bannock Quad Tank tracks

T 10N, R21E, Sec. 18 Bannock Quad Roadway

T 10N, R21E, Sec. 18 Bannock Quad Tent area

T 10N, R20E, Sec. 20 Bannock Quad Control

Area 1 Jawbone Canyon

Dove Springs

Aerial Photograph Calibration Data

1. Jawbone Cyn.

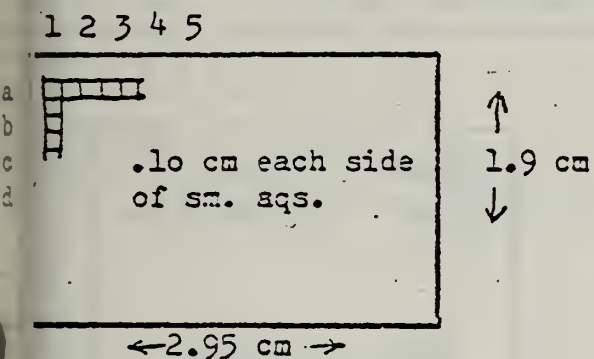
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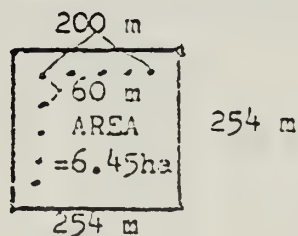
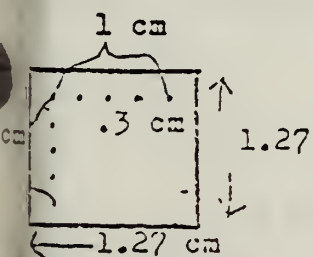
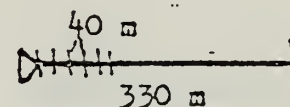
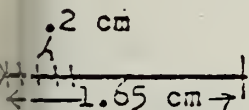
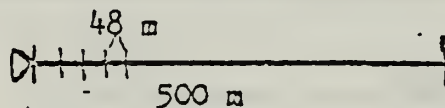
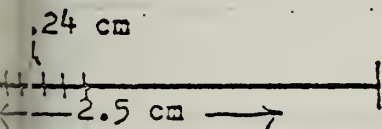
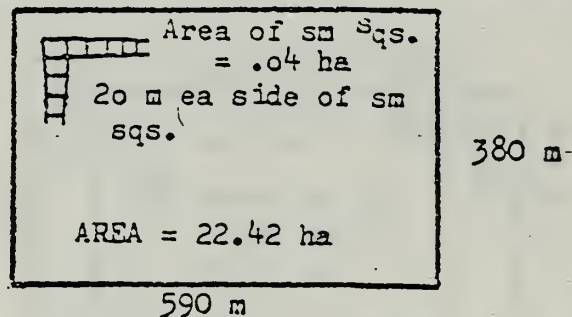
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Aerial Photograph Grid Measurements



On Ground Equivalent Measurements



Aerial Photograph Calibration Data

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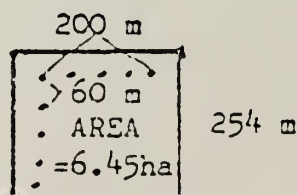
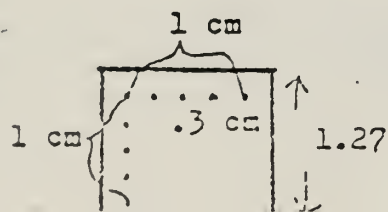
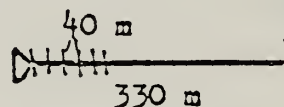
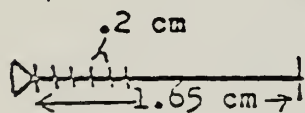
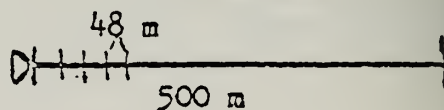
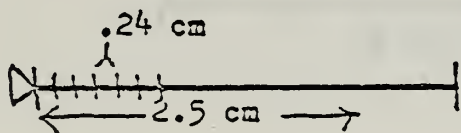
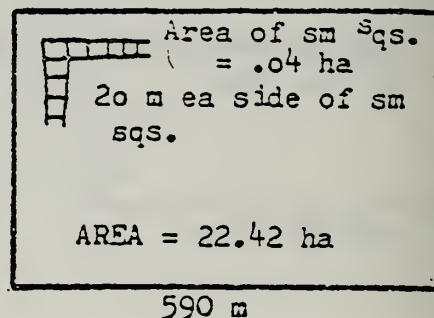
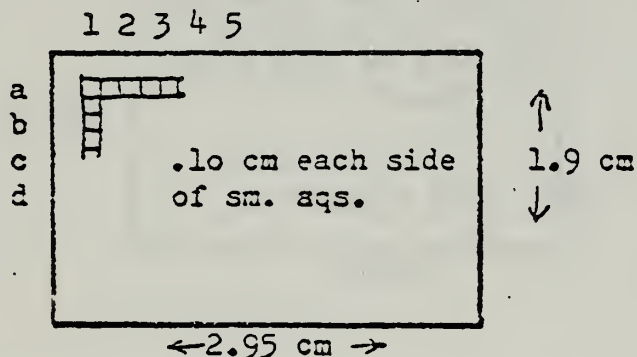
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Photo Nos. ABL-6K 34-36, 92-94

RATIO: 1:20,000

Transparent Grid Measurements

On Ground Equivalent Measurements



PLANT RESPONSE PARAMETERS - RV and ORV in CECA, Ca.

Aerial Photograph Calibration Data

Dove Springs

Date: 10-15-52

Photo size:

9x9

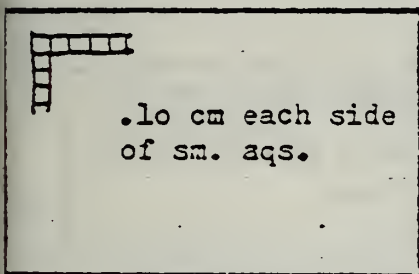
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Apparent Grid Measurements

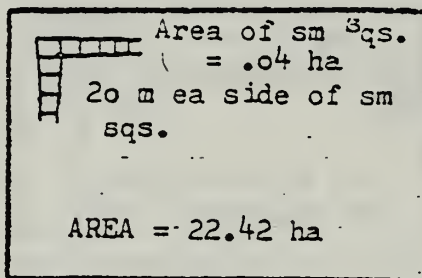
On Ground Equivalent Measurements

1 2 3 4 5



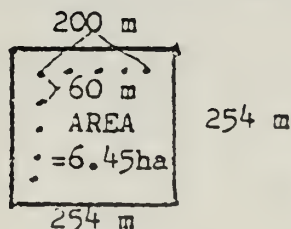
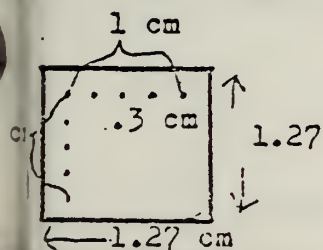
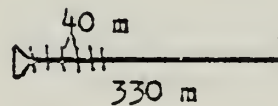
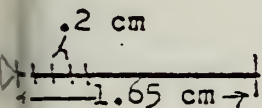
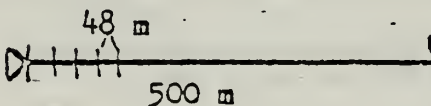
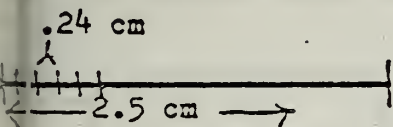
$\uparrow 1.9 \text{ cm} \downarrow$

$\leftarrow 2.95 \text{ cm} \rightarrow$



AREA = 22.42 ha

590 m



PLANT RESPONSE PARAMETERS - RV and ORV in CDCA, Ca.

Aerial Photograph Calibration Data

AREA: 1 Dove Springs

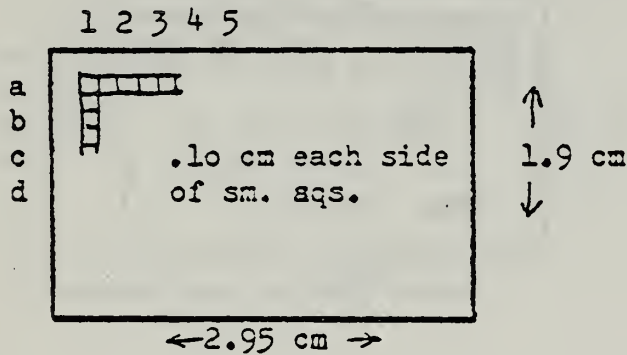
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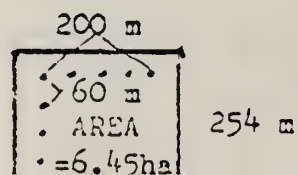
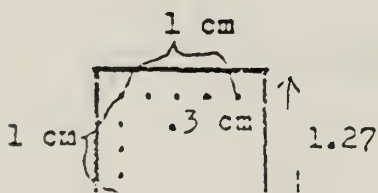
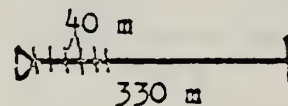
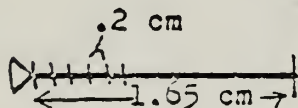
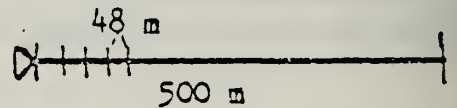
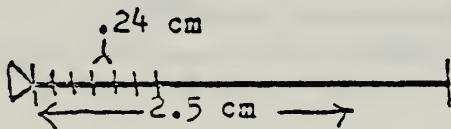
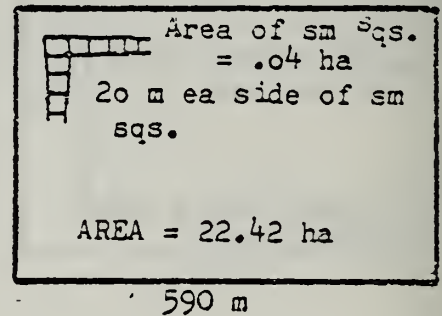
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Transparent Grid Measurements



On Ground Equivalent Measurements



Aerial Photograph Calibration Data

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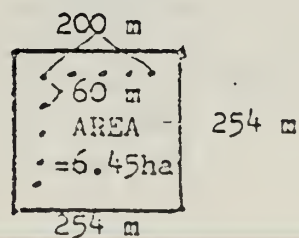
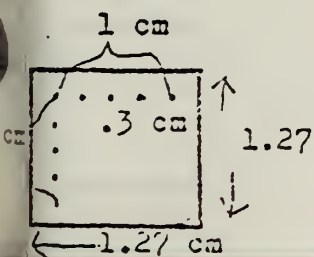
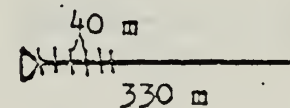
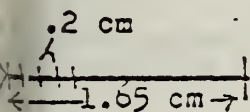
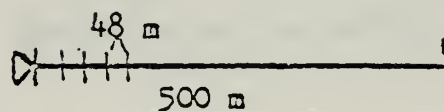
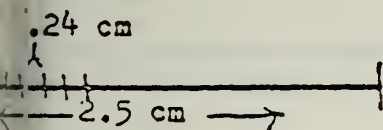
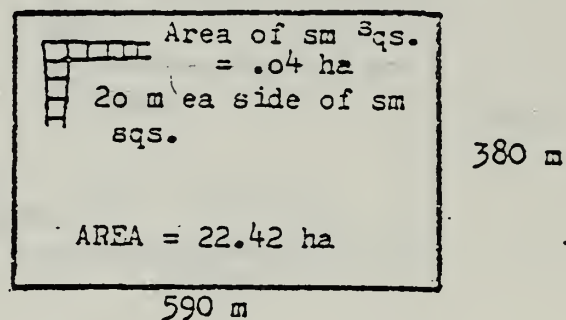
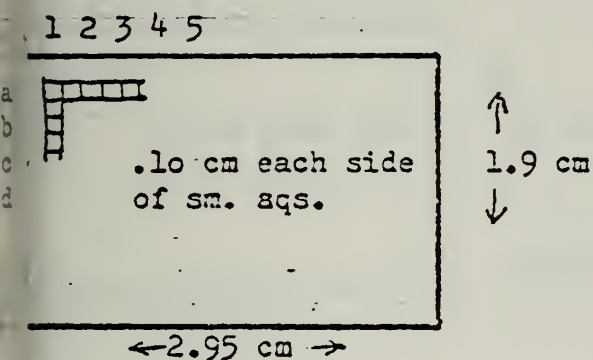
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120,000

Present Grid Measurements

On Ground Equivalent Measurements



Area 2 Stoddard Valley

Aerial Photograph Calibration Data

Stoddard Valley

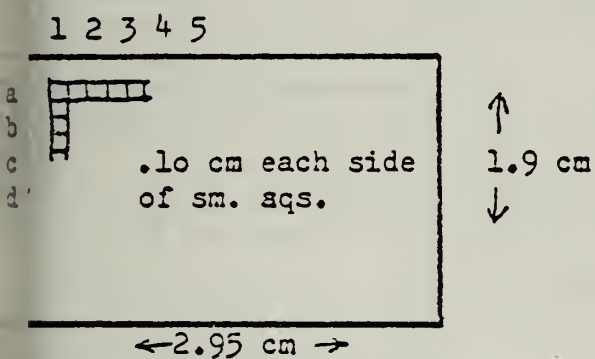
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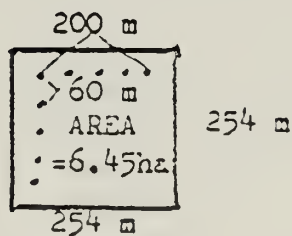
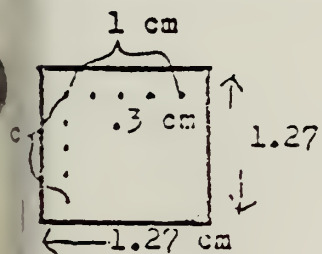
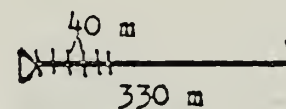
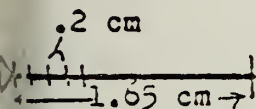
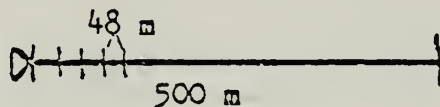
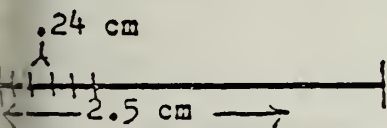
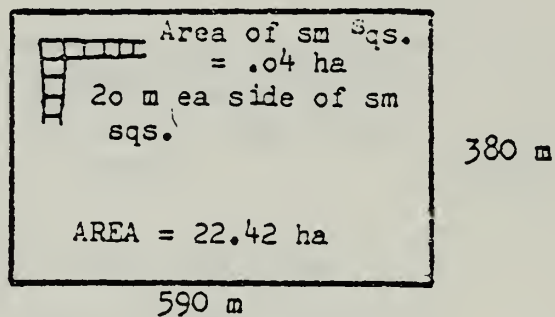
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120,000

Present Grid Measurements



On Ground Equivalent Measurements



Area 3 Johnson Valley

Aerial Photograph Calibration Data

Johnson Valley

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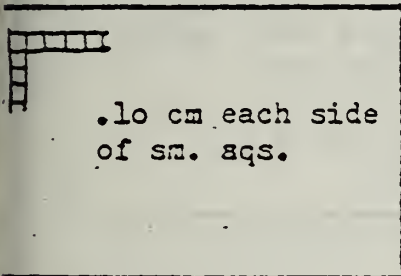
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Aerial Grid Measurements

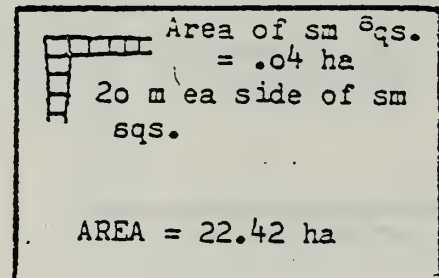
On Ground Equivalent Measurements

1 2 3 4 5



←2.95 cm →

↑
1.9 cm
↓

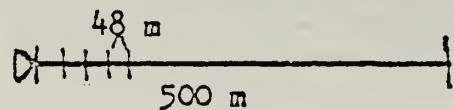
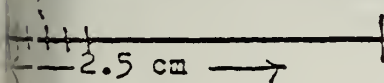


AREA = 22.42 ha

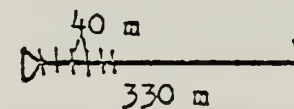
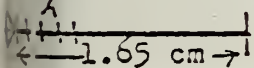
590 m

380 m

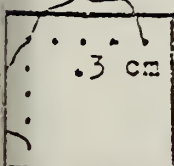
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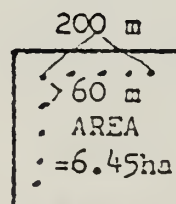
.2 cm



1 cm



1.27



254 m

254 m

Aerial Photograph Calibration Data

AREA: 3. Johnson Valley

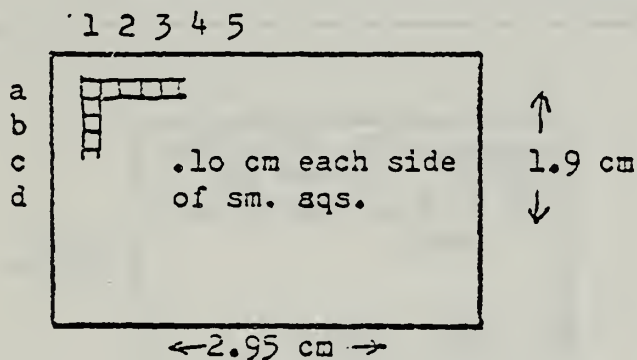
Photo Date: 5-28-77

Photo size: 9 x 9"

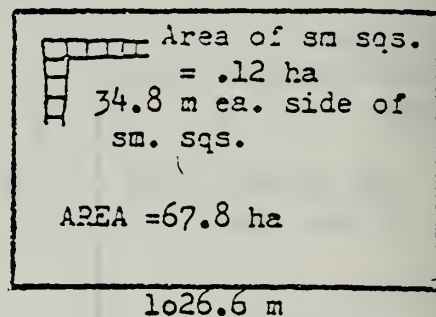
Photo Nos. BLMCA 93-77 6-10-14 BLM CA 93-77 5-11 BLMCA 93-77-6-11-15

RATIO: 1:34,800

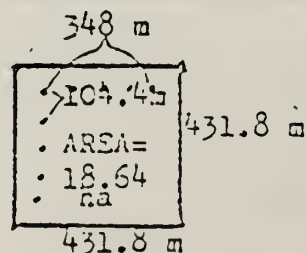
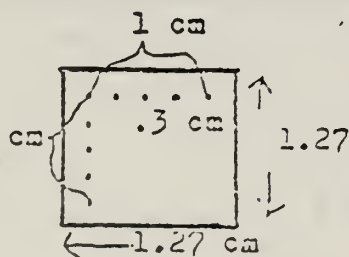
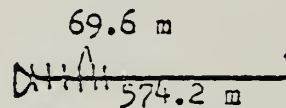
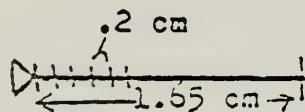
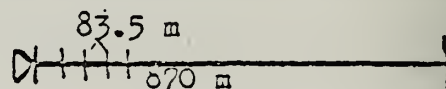
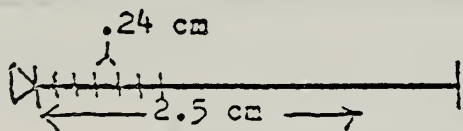
Transparent Grid Measurements



On Ground Equivalent Measurements



661.



Area 4 Afton Canyon

Kelsa Dunes

EA: 4. Afton Cyn.

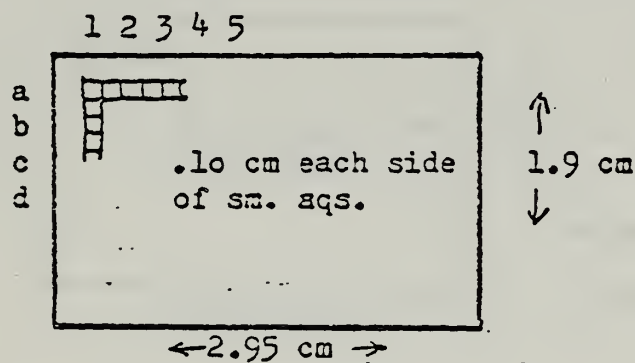
Photo Date: 11-18-52

Photo size:

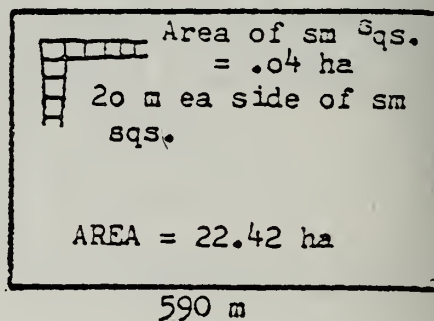
Photo Nos. AXL-10K-26-28, 176-178, AXL-11-K-105, 106, AXL-9K-111-113

Ratio: 1:20,000

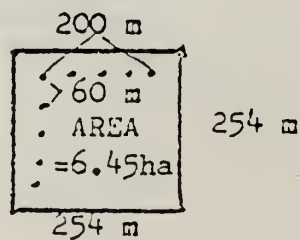
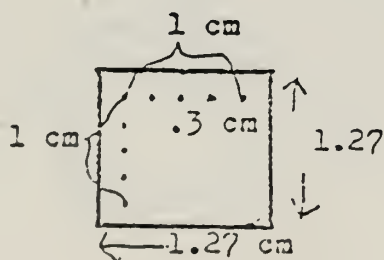
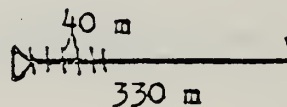
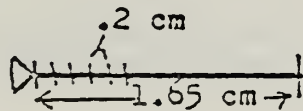
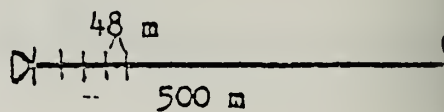
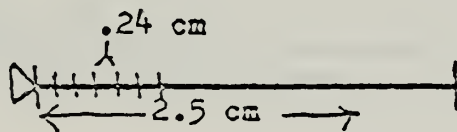
Transparent Grid Measurements



On Ground Equivalent Measurements



38



Aerial Photograph Calibration Data

also Dunes

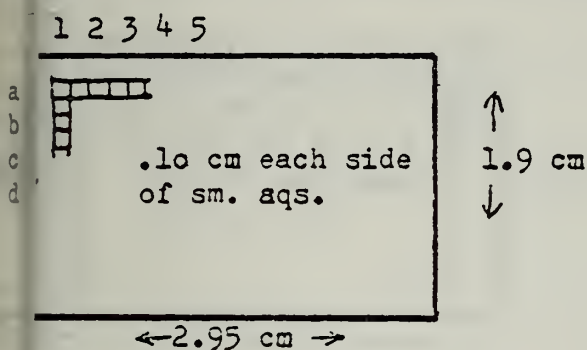
Date: ? 2-8-76

Photo size: 9 x 9

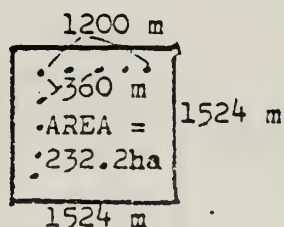
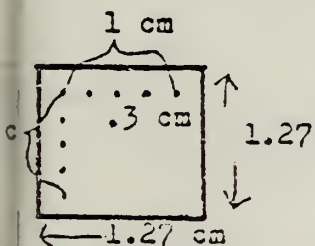
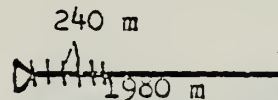
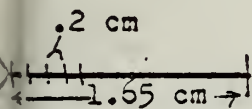
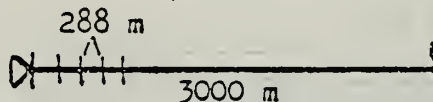
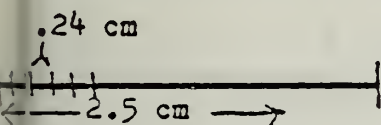
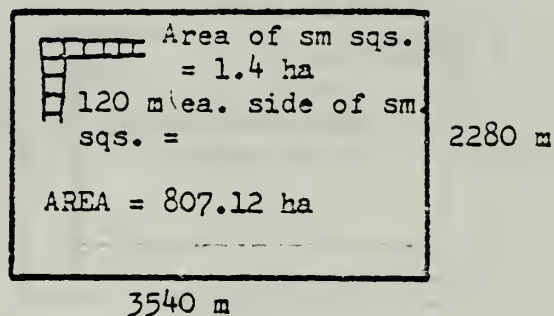
No. U-2 photo UAG 1045, 153.22-1278, 2877, 2876

1:20,000

Aerial Grid Measurements



On Ground Equivalent Measurements



A: 4. Kelso Dunes

Photo Date: 4-14-53

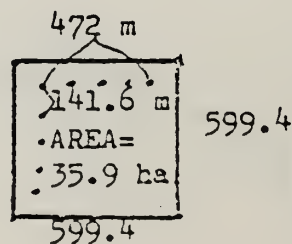
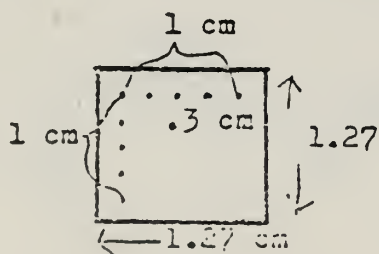
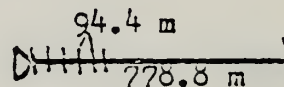
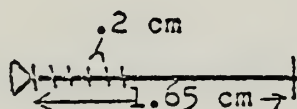
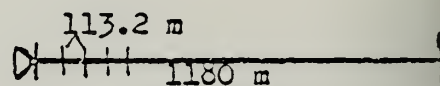
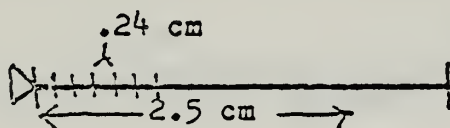
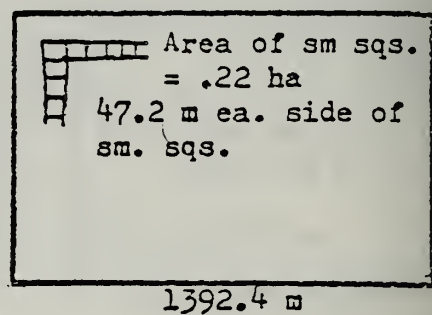
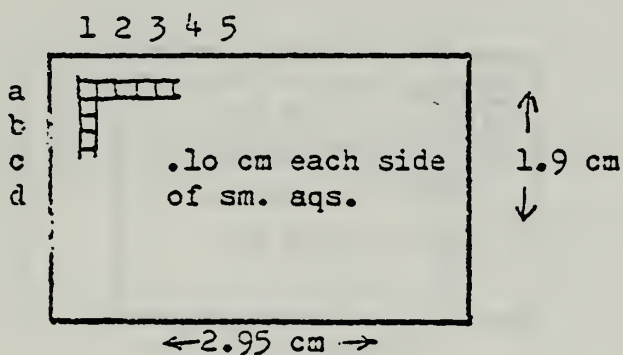
Photo size: 9 x 9"

Photo Nos. 1046 CS3720 GS-YP 1-60, 61, 1010 CS 3720 GSYP 1-1,2

ATTO: 1;47,200

Transparent Grid Measurements

On Ground Equivalent Measurements



Aerial Photograph Calibration Data

4. Kelso Dunes

Date: Oct. 9, 1954

Photo size: 18 x 18"

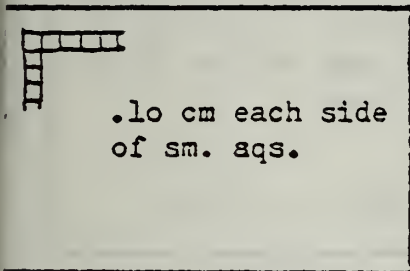
No. VVFS-M60 AMS 145-4593-4597

43,200

Present Grid Measurements

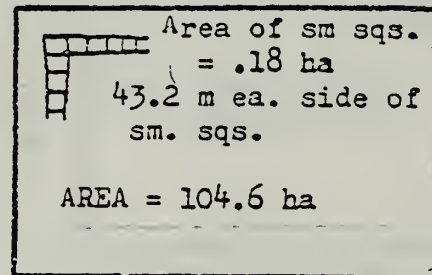
On Ground Equivalent Measurements

1 2 3 4 5



↑
1.9 cm
↓

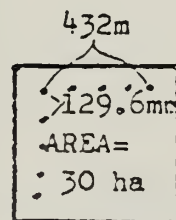
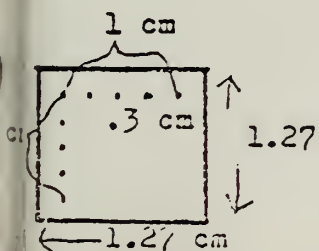
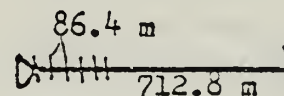
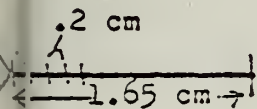
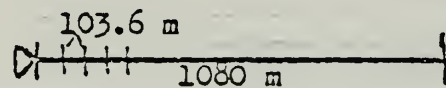
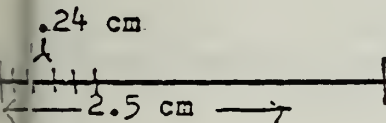
←2.95 cm→



AREA = 104.6 ha

820.8 m

1274.4 m



548.6 m

Aerial Photograph Calibration Data

AREA: 4 Kelso Dunes

Photo Date: 6-9-74

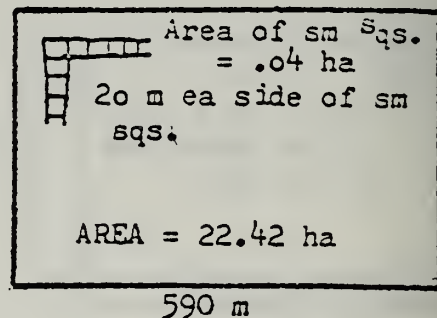
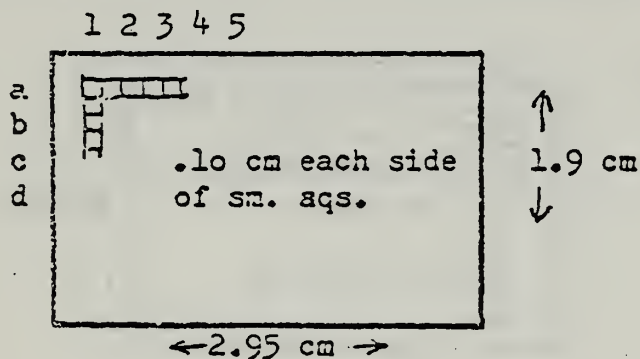
Photo_size: 9 x 9"

Photo Nos. BLM-C-M000 12-58-60

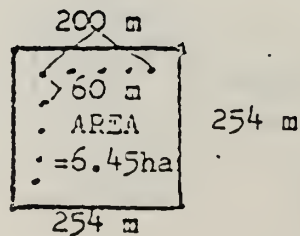
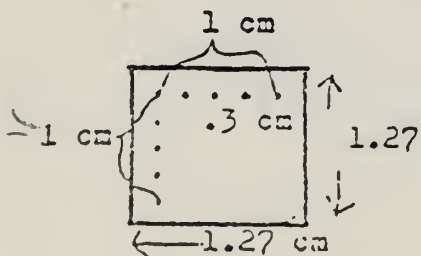
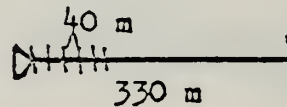
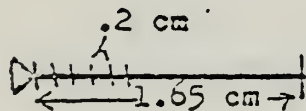
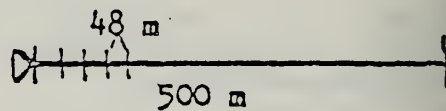
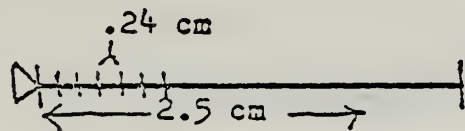
Ratio: 1:20,000

Transparent Grid Measurements

On Ground Equivalent Measurements



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Area 5 Plaster City

AREA: 7B Patton

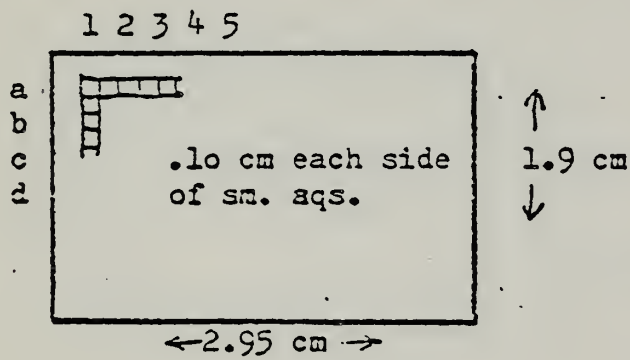
Photo Date: 6-9-74

Photo size: 9 x 9

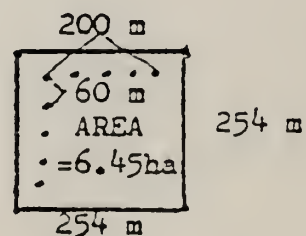
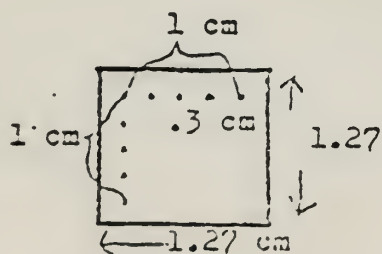
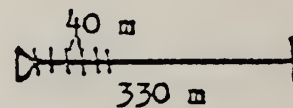
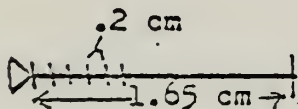
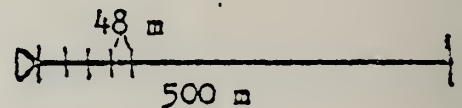
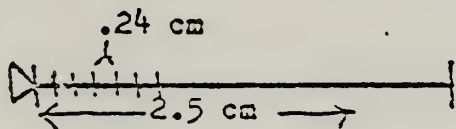
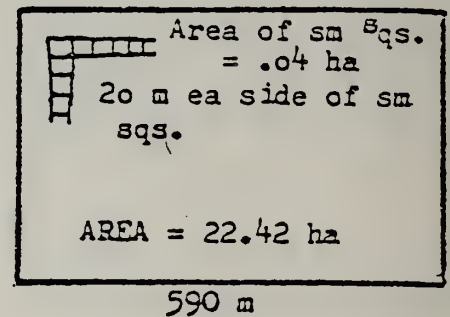
Photo Nos. BLM-C-M000 17-9, 10, 11 18-7, 8 16-11, 12, 13, 14

RATIO: 1:20,000

Transparent Grid Measurements



On Ground Equivalent Measurements



Card

lant response parameters to
vehicles ...

	Division	Date Ret'd

DSC 1279-3c (Feb. 1977)

